NATIONAL TUBERCULOSIS ASSOCIATION

SEVENTEENTH ANNUAL MEETING

NEW YORK CITY

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TRANSACTIONS OF THE SEVENTEENTH ANNUAL MEETING

NEW YORK CITY, JUNE 14, 15, 16 AND 17, 1921

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SEVENTEENTH ANNUAL MEETING

OF THE

National Tuberculosis Association

The Seventeenth Annual Meeting of the National Tuberculosis Association was held at the Waldorf Astoria Hotel, New York City, on June 14, 15, 16 and 17, 1921.

The meeting was called to order at 2 o'clock on Tuesday afternoon by the President, Dr. Gerald B. Webb.

Following the address of welcome by Dr. Hermann M. Biggs, Chairman of the Honorary Committee of Arrangements, the address of the President was presented and filed for publication in the Transactions. (See page 26.) The report of the Executive Office for the year ending June 1, 1921, was read and ordered filed. (See page 32.)

The report of the Nominating Committee, which had been appointed in March, was presented by the Chairman, Dr. Lee K. Frankel.

In view of the fact that a new constitution and by-laws were ratified by the Board of Directors at its meeting on March 11, 1921, following the recommendation of the Committee on Reorganization, it became necessary for the Nominating Committee to nominate a new board of directors under the new by-laws. The Board is to consist of representative directors, nominated by "represented affiliated" associations and, in addition, fifty directors at large. The report of the Committee on Nominations was as follows:

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New York City, N. Y.
Mr. Morton D. Hull,
Chicago, Ill.
Mr. Sherman C. Kingsley,
Philadelphia, Pa.
Dr. Roger I. Lee,
Cambridge, Mass.
Dr. Paul A. Lewis,
Philadelphia, Pa.
Dr. David R. Lyman,
Wallingford, Conn.
Dr. Alfred Meyer,
New York City, N. Y.
Dr. George M. Price,
New York City, N. Y.
Mr. Julius Rosenwald,
Chicago, Ill.
Mr. Fred M. Stein,
New York City, N. Y.
Dr. Charles Stover,
Amsterdam, N. Y.
Mrs. F. E. Whitley,
Webster City, Iowa.

The report of the Nominating Committee was approved and the names were forwarded for formal election to Portland, Me., where the corporate meeting of the members of the National Tuberculosis Association was held on Wednesday, June 15th, at 12 o'clock noon. The directors listed above were duly and legally elected.

Over 1,000 persons were registered at the meeting and a considerable number who attended were not registered.

The Clinical Section held three meetings and the Pathological Section two meetings. A combined session of the Clinical and Pathological Sections was also held. The Advisory Council held one session, the Socio-

logical Section three sessions, the Nursing Section two sessions. There was also a combined session of the Sociological and Nursing Sections. Under the direction of the local committee on arrangements, several unique features were provided, among which were an exhibit, a demonstration by the health clown, "Humpty Dumpty," and a pageant "The Spirit of the Double-Barred Cross."

The following Committee on Resolutions was appointed by the President:

Dr. George M. Kober, *Chairman,* Washington, D. C.;
Dr. Philip King Brown, San Francisco;
Dr. Vincent Y. Bowditch, Boston;
Dr. E. R. Baldwin, Saranac Lake;
Dr. J. W. Pettit, Ottawa, Ill.

On behalf of the Committee on Resolutions, Dr. George M. Kober, Chairman, presented the following resolutions with the endorsement of the Committee. Each of the resolutions was adopted unanimously.

1. Medical Education.

WHEREAS, The National Tuberculosis Association has always been deeply concerned with the subject of medical education in tuberculosis, and

WHEREAS, The movement for the inauguration of special departments of tuberculosis has as yet been taken up by very few of our medical schools, and

WHEREAS, We regard the spread of this movement as of vital importance to the future development of all tuberculosis work, be it therefore

Resolved:

First, That the medical schools of our country be urged to take special account in the development of their curricula of the necessity for the establishment of such departments.

Second, That in the question of the location of new sanatoria due consideration be given to placing them whenever possible where their facilities will be available for the development of such special tuberculosis departments in our medical schools.

2. Rehabilitation of Ex-Service Men.

WHEREAS, The rehabilitation of our tuberculous ex-service men and women is at once our most imperative duty and the biggest problem in public health before our people, and

WHEREAS, The National Tuberculosis Association through the coöperation with the government services, both of the executive staff and of its individual members, has acquired a close familiarity with the work of these various services and especially that of the tuberculosis hospitals, and

WHEREAS, The best results in these hospitals can only be attained by the maintenance of a close coöperation of physicians and patients under strict disciplinary regulations, and

WHEREAS, Such conditions do not at present generally exist in government tuberculosis hospitals in spite of the continuous and conscientious efforts of the government departments, and

WHEREAS, The chief causes of this fatal defect are: first, the demoralizing influence upon many of the men of the present compensation act and its administration; second, the failure of the public, of the Congress, of the local posts of the American Legion and of other organizations interested in the welfare of ex-service men, to familiarize themselves with the facts of the tuberculosis situation and to bring to the aid of the government departments that intelligent coöperation which they sorely need and without which they cannot do their best work; be it therefore

Resolved, That it be urged upon Congress both by the executive office of the National Tuberculosis Association and by each affiliated state association through the members of its state delegation, that the government departments be given the assistance necessary to establish the discipline so essential to the maintenance of this needed morale by:

First, Such changes in the compensation act as will result in the immediate and material reduction in compensation for those cases who refuse to make proper use of the facilities provided for their benefit, and

Second, By making the welfare of the men and of the country at large, and *not* the desires of the individual constituents, the basis of action both as regards appointments of those *charged* with the care of these men, and as regards the individual cases of the men themselves.

Resolved, That the National Tuberculosis Association hereby expresses its appreciation and commendation of the efforts thus far of the national officials of the American Legion to have corrected the defects in legislation pertaining to rehabilitation of ex-service men, and its administration, and urges the Legion to continue these efforts and to see that its local posts throughout the country give their full coöperation to the government departments in their efforts to prevent an uncontrolled minority of the ex-service men from seriously interfering as they now do with the chance of the recovery of their fellow patients.

Resolved, That the local tuberculosis associations throughout the country be urged to inaugurate immediately a campaign of publicity, which will give the people of their respective localities the true facts of the situation, and will develop in all parts of the country that educated public opinion, the lack of which has been largely responsible for the present unfortunate situation.

3. Sheltered Training and Employment of the Tuberculous.

Resolved, That the National Tuberculosis Association approves the principles involved in sheltered training and employment for the tuberculous, and the necessity for providing various forms of sheltered employment as a necessary and important factor in the management of the tuberculosis problem.

In view of the various existing means for providing such sheltered employment and the extension of these ideas into the consideration of various plans for industrial and agricultural settlements by governmental and non-governmental agencies, the National Tuberculosis Association invites the attention of these agencies to the large amount of data gathered by its Committee on Farm Colonies and Industrial Communities for the Tuberculous, which the executive office is directed to place at the disposal of all of those interested in the problem.

It is the sense of the National Association that the many difficulties, objections and criticisms of proposals for agricultural and industrial settlements demand a most careful and continued study of all the medical, economic and political factors involved, and it desires to express its interest in the elaboration of these proposals; and therefore directs the continuation of this committee, to prepare and present at the next annual meeting a complete digest of the information that it gathers

4. Immigration and Tuberculosis.

WHEREAS, The admission of immigrants with tuberculosis has provided our state and municipal institutions with a large number of cases of pulmonary tuberculosis because of the absence of a physical examination on entrance into this country, and

WHEREAS, These immigrants with tuberculosis create a social and economic problem which is likely to be greater and more important during the present period of depression in Europe, therefore be it

Resolved, That the National Tuberculosis Association in conference assembled ask that the United States Public Health Service detail medical examiners especially trained in tuberculosis work to be stationed at ports of debarkation and further that steamship companies be encouraged to protect themselves from the burden of returning such cases by some type of examination or health certificate at port of embarkation.

5. General William C. Gorgas.

WHEREAS, The National Tuberculosis Association has lost by death Major General William Crawford Gorgas, U. S. A., Honorary Vice-President, therefore be it

Resolved:

First, That this Association commemorates the great services of General Gorgas as a sanitarian whose world-wide activities have resulted in the practical elimination of one of the worst scourges of mankind, yellow fever, and in the successful combating of other communicable diseases.

Second, That it deplores the loss of this great man, this good friend and modest and kindly gentleman, whose memory will always be cherished not only on account of his unparalleled services to humanity but also for his qualities of mind and heart.

Third, That the National Tuberculosis Association extends the sympathy of its members to the wife and family of its deceased member.

Fourth, That a copy of these resolutions be forwarded to Mrs. Gorgas.

6. Mexican Department of Public Health.

WHEREAS, There exist between this country and the Republic of Mexico many common health problems the chief of which is tuberculosis, and

WHEREAS, The President of Mexico through the Department of Public Health has extended an invitation to the National Tuberculosis Association to hold its meeting in 1922 in Mexico City, be it

Resolved, That this Association express to the President of Mexico its appreciation of the invitation and its desire to further the intimate consideration of that special part of our common medical problem for which this Association was organized, and

That the Association regrets its inability to accept the invitation for 1922 on account of the triennial meeting of all the national medical societies in Washington that year; and be it

Further Resolved, That this Association invite the Department of Public Health and interested members of the profession in Mexico to meet with it on the occasion of the next annual meeting in Washington, D. C.

7. Use of Local Hospitals for Early Cases.

WHEREAS, The National Tuberculosis Association has always advocated that advanced cases of tuberculosis be cared for in separate wards in the general hospitals of their own towns, and

WHEREAS, There is an unfortunate tendency in some quarters to interpret this to mean that the incipient or favorable case can also be treated efficiently in such local hospitals, be it therefore

Resolved, That the National Tuberculosis Association, while strongly reaffirming its previous stand on the local hospitalization of advanced cases, does not approve of the suggestion of caring for the incipient or favorable case in like manner, and for the following reasons:

First, It has been well proven that the favorable case can have his best chances only in institutions situated outside of the cities and with a régime centered on the education of the patient for his after life, along with his physical rehabilitation, and

Second, It is disadvantageous to arrange for the treatment of the curable case in connection with the advanced cases, because of the depressing mental effect which prevents the incipient case coming for treatment at the only time when it can be prevented from developing into an open case and an active focus for the spread of the disease.

The following motion made by Dr. E. O. Otis, was carried unanimously:

Resolved, That the sincere thanks of the Association be given to the members of the local committee, the staff of the National Association, to the managers of this hotel and to all others who have made this meeting so successful by their services.

The following resolution was presented in connection with the Summary Report of the Committee on Dusty Trades to the Executive Committee and approved with the understanding that the resolution be published with the resolutions adopted at the Annual Meeting.

The Directors of the National Tuberculosis Association having completed an investigation of the mortality from tuberculosis in the granite industry under the auspices of a special committee, after which an x-ray and physical examination was made of more than 400 men in the city of Barre, Vermont, hereby make the following resolutions:

WHEREAS, It has been demonstrated by the death certificates of men employed for varying periods, ranging from ten to forty years in the trade of granite stone cutting, that an unusually high and increasing death rate from pulmonary tuberculosis prevails,

(2) That this occurs in men of good physique and previous good health who usually undergo heavy work with ease,

(3) That the repeated inhalation of fine dust resulting from the cutting of granite, especially since the introduction of pneumatic tools, induces in the large majority of men so employed a condition known as silicosis, due to deposits of this dust in the lungs which predisposes them to tuberculosis and aggravates any existing disease of the lungs.

(4) That by means of an x-ray and physical examination of the chest these diseases can be recognized in an early stage, be it

Resolved, That this Association urges:

(1) The adoption of more efficient methods of removing the fine dust, the isolation of the most dusty operations so far as may be practicable and of general sanitary measures to prevent infection in the sheds,

(2) The introduction of a system of periodic physical examinations by trained physicians selected for this duty; also that obligatory x-ray examinations by skilled technicians shall be required at the same time for all men entering the trade and while engaged therein.

On behalf of the Committee on Indigent Migratory Consumptives, Mr. James H. Pershing, Chairman, presented a report. On motion duly made and carried, it was ordered that the report be accepted and the Committee continued. The report of the Committee follows:

RECOMMENDATIONS OF THE COMMITTEE ON INDIGENT MIGRATORY CONSUMPTIVES.

In view of the findings of the recent study of the Indigent Migratory Consumptive in the cities of Denver, Colorado Springs, Los Angeles, San Antonio, El Paso and Phoenix, recently made by Miss J. S. Whitney, the committee would like to present the following conclusions and recommendations:

There were 7319 indigent tuberculous individuals in the six cities, or one to every 155 of the entire population of those cities.

Sixty-three per cent. of these were non-residents; *viz,* had resided in these cities less than two years.

Five hundred and forty-five, or 16 per cent. of all non-residents made application for aid within a week after arrival, and one-third before they had been there a month; 50 per cent. before they had been resident three months, and nearly 90 per cent. when they had been there one year or less.

One-tenth of all these tuberculous individuals were children under 14 years of age.

There were 9315 other members of the immediate family living in the households with the tuberculous people.

The six states from which most of the migration comes are Illinois, New York, Missouri, Ohio, Pennsylvania and Michigan.

One in every 8 cases died.

The per capita cost to each member of the population in those cities varies from 22 cents in San Antonio, to $1.75 in Phoenix.

None of these cities has anything like adequate provision, medical, relief, or institutional, for caring for the tuberculous, whether resident or non-resident.

The committee, therefore, recommends that:

1. The report prepared by Miss J. S. Whitney be elaborated for publication and distribution.

2. That this committee be continued.

3. That one of the cities of the middle-west or east be surveyed in a similar way, preferably Cleveland, and that the School of Social Work in Chicago be asked to make a similar study there.

4. That publicity for the six states from which most of the migration comes be prepared and distributed immediately.

For the Committee,

JAMES H. PERSHING,
Chairman.

At a meeting of the Board of Directors on Wednesday, June 15th, the following officers were elected for the ensuing year:

Dr. James Alexander Miller, New York, President.
Hon. Warren G. Harding, District of Columbia, Honorary Vice-President.
Col. George E. Bushnell, Massachusetts, Honorary Vice-President.
Dr. Lawrason Brown, New York, Vice-President.
Dr. Ralph Matson, Oregon, Vice-President.
Dr. George M. Kober, District of Columbia, Secretary.
Mr. Henry B. Platt, New York, Treasurer.

The following directors, in addition to the President, the Vice-President, the Secretary, and the Treasurer, ex-officio, were elected to serve on the Executive Committee for the ensuing year:

Dr. William Charles White, Pennsylvania,
Dr. H. Kennon Dunham, Ohio,
Dr. Alfred Henry, Indiana.
Dr. W. L. Dunn, North Carolina,
Mr. Homer Folks, New York,
Dr. David R. Lyman, Connecticut,
Mr. Sherman C. Kingsley, Pennsylvania.

Dr. Webb appointed Dr. G. W. Holden and Dr. Martin F. Sloan as members of a Committee to meet with the American Sanatorium Association Committee of Two, to devise and determine disciplinary standards for ex-service men.

ADDRESS OF WELCOME

Dr. Hermann M. Biggs, New York: Mr. President and members of the Association — It is a great privilege and pleasure, on behalf of the general committee and the public health officials of New York State, to welcome the members of the National Association at this meeting in New York. It seems quite appropriate that after so many years of active, useful work, the National Association should come to New York for its annual meeting, as it was in New York that the inception and the development of the first organization occurred.

Dr. Knopf has followed out in a very interesting fashion the history of the development and of the work of the Association, in the book which he has prepared and which I hope will soon be published by the Association. At a time like this, one's thoughts inevitably go back over the years which have passed, and I am impressed at once with the fact that there are very few of those who were identified with the original anti-tuberculosis movement in the United States who are left.

Many of the younger members of the Association think of the anti-tuberculosis movement as beginning in 1900 or 1904 or later. There was one very prominent tuberculosis worker who dated it in an address before the Academy of Medicine as 1908.

Those are not the facts. The real contest came far earlier and previous to the year 1900. It was in fact in 1887, in 1888, in 1891, 1898 and 1899, that the most difficult work and the most severe struggles in the anti-tuberculosis campaign were met. The men who were identified with the activities of that time have, for the most part, passed away. There are a few men — Dr. Bowditch, Dr. John S. Billings, Dr. Alfred Meyer and perhaps one or two others — but very few, who are left.

Dr. Prudden, whom most of you would not think of possibly in connection with this work, was one of the earliest and one of the most enthusiastic of the workers of that time, and he and Dr. Henry P. Loomis joined with me in the original communication on the causation and prevention of tuberculosis, which was sent to the New York City Health Board in 1887.

In the years following, Dr. Prudden was one of the most active of the anti-tuberculosis workers. After the New York City Health Department in 1896 finally made the registration of tuberculosis compulsory, there was a revulsion in the medical profession against the activities of the health authorities, and during the three years following, viz., in '97 and '98 and '99, I spent a large part of my time during the sessions of the Legislature in Albany in efforts (which were finally successful) to block legislation which had been formulated by special committees of the New York County Medical Society and the Medical Society of Greater New York. This legislation was designed to take away entirely from the city health authorities, all power to deal with tuberculosis in any way.

At that time the great majority of the medical profession was violently opposed to the registration of tuberculosis and to the anti-tuberculosis program of the Health Board.

For this reason I say that it was in those earlier years that the great opposition to the anti-tuberculosis movement existed and the great difficulties in the campaign were met. We can hardly understand now how small a proportion of the medical profession for years accepted the tubercle bacillus as the etiological factor in tuberculosis, or believed in the communicability of the disease.

In 1887 and 1888, after the receipt of the report of Dr. Prudden, Dr. Loomis and myself, previously referred to, the New York City Board of Health approached a large number of the most prominent men in the medical profession in New York with reference to the adoption of the program for the control of tuberculosis, recommended in this report, and there were only two of the men whom they approached who were in favor of such action, namely: Dr. Edward G. Janeway, and Dr. Frank Foster, formerly editor of the New York Medical Journal.

In 1896, when the New York City Health Department finally made tuberculosis registration compulsory, because of the intense opposition in the profession I appealed to the New York Academy of Medicine. The

President of the Academy of Medicine appointed a committee of most distinguished medical men to consider the matter. The committee had repeated meetings, covering a long period of time and finally brought in a report in which they declared the action of the Health Board "inexpedient and inadvisable." This was in 1897.

I say we can hardly understand how many years it required to educate the medical profession and the laity to a belief in the communicability of tuberculosis.

Now when one compares the situation in those earlier days with that of to-day, when the tuberculosis death rate has been reduced to a half or nearly a third (at the present time it is just about a third of what it was in New York City when we began the work; it was then 35 per 10,000 or 36 per 10,000, and this last year it is a fraction over ten), we realize what enormous progress has been made.

While all this advance cannot be ascribed to the work of the various official and voluntary organizations which have been active in the campaign there can be no doubt that the National Tuberculosis Association has been a factor of the greatest import in bringing about the situation which exists to-day. The situation in this country is, I believe, more nearly what one would like it to be than it is anywhere else in the world.

I have great pleasure in welcoming, on behalf of the Public Health Officials of New York State, and the General Committee, the members of the National Association.

* * * * * * *

At a general meeting held on Thursday, June 16th, at which Dr. Webb presided, Dr. James Alexander Miller, the newly elected president of the Association, was introduced. Dr. Miller spoke as follows:

Dr. J. A. Miller, New York: Mr. President, Members of the National Tuberculosis Association: I am sure it is needless for me to tell you how deeply I appreciate the honor which I feel has so undeservedly been conferred upon me. I think it is not too much to say that anyone particularly interested and active in tuberculosis work cannot help but feel that to have been thought worthy of being president of this Association is an honor second to none, and I feel very appreciative, but peculiarly humble because of the long line of illustrious predecessors who have gone before me, and who have made this wonderful, strong, virile Association what it is today.

Although I feel distinctly unequal to the task, I assume with deep pleasure and with all the earnestness and devotion of which I am capable, the responsibility which the acceptance of this office entails. I am sure you will all appreciate, however, the fact that no one can accomplish anything in any organization without the full and complete support of every member and every unit in it.

We are, this year, I take it, particularly in a position where that is important. We have just had a reconstruction of our methods of organization, and I think it has been distinctly toward betterment. It has been

a period of reorganization and reconstruction, however, in which those charged with duties of administration needed your unswerving devotion and support, and we now shall need it as others have had it in the past.

More than that, I think we can feel, those of us in the tuberculosis movement, that just now we are beginning to see a few of the results which we have hoped for and striven for all of these years, and which we were not any too sure how we might achieve. In other words, I think we can see the beginning of the end of tuberculosis. All over the land the death rate is going down, so much so that many of us have not dared to feel that it was really a permanent change; but it still continues to go down in such a way that it would appear to confute the doubt.

At the same time, as we are enjoying this remarkable decrease, certainly in part a result of our work, we see because of the war a tremendous increase in the amount of tuberculosis which threatens destruction to a large part of the countries and the population of Europe. So that we have before us a tremendous problem. In America, with an organization second to none in the world, we see before us the results of the earnest and hard work which those who went before us have done. On the other hand, we see the object lesson of what the lack of this is doing to the rest of the world.

This gives to us, as Americans, a peculiar responsibility, and I am sure that we as an Association will be able to live up to it. Although the medical aspects of this problem (and it has been my privilege to be particularly near to the medical aspects of this problem in the past, although not entirely oblivious, of course, to the great social problems behind it, and also the scientific aspects of tuberculosis, as our President expressed it in his masterly address) must be the foundation of our knowledge and progress in the disease, this year as an executive officer, I feel that I should like, if possible, to come a little closer to the problems of every day which confront the actual workers in the field.

Therefore, inasmuch as I shall not have another opportunity to do so before undertaking active duties of the office of president of this Association, I am going to ask if the active workers, the executive officers and secretaries who are actually doing the work in the field of this Association, would be good enough to meet with me in the East Room this afternoon about half-past five, in order that we may have a conference concerning some of the problems, actual field problems, with which I have been less familiar than some of the others in the field of tuberculosis.

I wish to thank you all for the honor which I feel is so undeserved, but which I will do my best to uphold in accordance with that which has been accomplished in the past by this Association.

REPORT OF THE TREASURER

New York City, June 6, 1921.

National Tuberculosis Association,
370 Seventh Avenue, New York City.

Gentlemen:

We are sending you herewith our report containing the statement of "Income and Expenditures for the year ended December 31, 1920," together with detailed analysis of the expenditures for the year.

It must be understood that the excess of income over expenditures amounting to $53,091.67 as shown on the Income and Expenditure statement does not include the expense of conducting the 1920 Xmas Seal Campaign. This expense will be carried over to 1921 to be applied against the percentage received from the campaign.

Very truly yours,
W. B. Richards & Co.

Report of the Treasurer for the year ended December 31, 1920.

Income

1919 Red Cross Seal Sale Percentage Available for Work of the Association			$203,011.43
Balance of 1918 Red Cross Appropriation for Tuberculosis Work			13,480.23
Dues			18,877.10
Donations			375.00
Interest Received on Bank Deposits			1,432.23
Discount Received on Purchases			2,139.82
Income from Rental of Office Furniture			40.00
Overpayments			6.69
Goods Purchased for Resale:			
Modern Health Crusade:			
Sales		$50,708.28	
Cost of Sales:			
Inventory January 1, 1920	$20,187.06		
Cost of Goods Purchased	43,365.51		
	$63,552.57		
Less: Inventory December 31, 1920	9,198.22	54,354.35	
			3,646.07
Other Publications and Supplies:			
Sales		$15,471.64	
Cost of Sales:			
Inventory, January 1, 1920	$14,000.00		
Cost of Goods Purchased	15,960.60		
	$29,960.60		
Less: Inventory December 31, 1920	13,375.31	16,585.29	
			1,113.65

American Review of Tuberculosis:		
Income from Subscriptions	$3,483.22	
Income from Advertising	912.73	
	$4,395.95	
Cost of Producing Publication	11,192.24	
		6,796.29
Adjustment of Accounts Payable		35.00
Total Income		$227,841.49

EXPENDITURES

Administrative Service:		
Salaries	$19,536.73	
Traveling Expense	6,514.57	
Printing	5,479.95	
Office Equipment	114.95	
Proportion of General Expense	10,573.86	
		$42,220.06
Modern Health Crusade Service:		
Salaries	$9,946.69	
Traveling Expense	1,663.76	
Printing	45.34	
Proportion of General Expense	9,234.27	
		20,890.06
Medical Service:		
Salaries	$13,566.69	
Traveling Expense	1,853.82	
Printing	242.26	
Office Equipment	70.00	
Proportion of General Expense	7,620.60	
		23,353.37
Field Service:		
Salaries	$16,144.31	
Traveling Expense	7,950.13	
Printing	19.39	
Office Equipment	202.19	
Employees' Service	1,200.00	
Proportion of General Expense	17,956.68	
		43,472.70
Research Service:		
Salaries	$6,299.96	
Traveling Expense	96.61	
Printing	24.75	
Office Equipment	21.45	
Proportion of General Expense	5,573.10	
		12,015.87

Publication and Publicity Service:

Salaries	$8,056.24	
Traveling Expense	269.67	
Printing	6,943.14	
Office Equipment	96.25	
Proportion of General Expense	20,170.63	
	$35,535.93	
Less: Amount Transferred from Missionary Fund	2,738.17	
		32,797.76
Total Expenditures		$174,749.82
Excess of Income over Expenditures for year ended Dec. 31, 1920		*53,091.67
		$227.841.49

* This does not include the expense of conducting the 1920 Xmas Seal Campaign. This expense being carried over to be applied against the income from the campaign, which will be received in 1921.

For list of contributors, life members and members see page 626.

TUBERCULOSIS: THE RATIONALE OF RESEARCH

By Gerald B. Webb, M.D.

Colorado Springs

Address of the President

We look on nature with our eyes, not with our reason.
Truth lies deep, and must be fetched up at leisure.

— Seneca.

To-day gives me the first opportunity to thank you for the great honor you conferred last year in making me President of the National Tuberculosis Association. The gift is the highest that can be received by one working in this field, and after twenty-five years of work in tuberculosis, gratitude, "the fairest blossom which springs from the soul", is your due.

The great world calamity through which we have passed, so far in safety, has led many to inquire where civilization now stands, and what is its future. Tuberculosis also, a concomitant of civilization, may well be reviewed in similar fashion at this time. We must frankly state our knowledge of the disease, and also the extent of our ignorance regarding tuberculosis, so that we can more wisely guide the efforts made in prevention and cure, and direct research to bring further enlightenment.

THE PRESENT STATE OF OUR KNOWLEDGE

Confucius said, "When you know a thing, to hold that you know it; and when you do not know a thing, to allow that you do not know it; this is knowledge." Let us briefly analyze our knowledge of tuberculosis in the spirit of this definition, considering first the things we know, then the things we do not know.

We know:

1. That tuberculosis is infectious, in origin parasitic.
2. That it is caused by a specific organism, the tubercle bacillus.
3. That certain more or less characteristic tissue changes in the victim occur in its course.
4. That the conflict between bacillus and host often ends very early in favor of the host — so early that the presence of the disease is not suspected during life.
5. That in the majority of the cases which are recognized clinically, the disease shortens life.
6. That its morbidity and mortality rates are still high throughout the civilized world.

7. That there are symptoms and signs, some or all of which are present in recognized cases.

8. That exhaustion and malnutrition in the host contribute to the development of the disease, while rest and adequate feeding favor resistance.

9. That of all the countless remedies proposed REST alone has stood the test of time.

10. That a tuberculin reaction indicates at least infection and invasion by the tubercle bacilli.

We do not know, or do not know thoroughly:

1. The biology of the parasite, how simple or complex, constant or variable is its life cycle.

2. The significance of variations in the parasite, as the human or bovine strains, their relation to each other and to the production of disease in various hosts.

3. The explanation of virulence and resistance, and the relative importance of these factors and of dosage in the development of the disease.

4. The rôle of family and racial heredity.

5. The relative importance of various modes of exposure and portals of infection.

6. The truth about such alleged predisposing factors as influenza and children's diseases.

7. The effect on the disease of syphilis or other co-existing infections.

8. The physiology of defense, and the part played in it by body fluids and special cells (for instance, the various leucocytes), tissues (for instance, lymphoid), and organs (for instance, adrenal and thyroid).

9. The absolute and relative frequency of healed and active tubercle, and the amount of variation of these figures in different localities and classes.

10. The occurrence of healed tubercle among savage races to whom tuberculosis is a new disease.

11. The relation of infection and lesion to immunity.

12. The effect of mental states on tuberculosis.

13. The effect of tuberculin, and the indications for its use in treatment, as well as the indications for rest, occupation and diet.

14. The possibilities of protective vaccination, and of chemical therapy.

15. The significance of mixed infections, and the factors concerned in toxæmia.

16. The effect of the anti-tuberculosis campaign and the relative importance of its various phases.

17. The clinical aspects of childhood infection, how to recognize this beginning infection, and how to safeguard the children until its arrest.

The list is not exhaustive, but serves to illustrate the little we know and the much we need to learn.

THE NEED FOR FURTHER RESEARCH

All will, I believe, agree that epoch-making discoveries in this disease have been limited to those of Laennec on the unity of the disease and the methods of its diagnosis, of Villemin on its infectiousness, of Koch in the discovery of the tubercle bacillus, of Von Pirquet in the application of tuberculin to the skin test, and of the surgeons and physicians who first applied the principles of rest.

It has seemed remarkable that in the past half century there have not been a score of laboratories in the world engaged in research work to add to our knowledge of tuberculosis. The tendency of the times has been to investigate diseases which gave promise of quicker solution, and to leave these more difficult problems to a few undaunted workers, themselves often its victims. Education of the people and of the profession, in what we know of the disease, must still be our first and foremost weapon. We cannot, however, stand still in our lack of knowledge, but we must definitely encourage progress by research.

We read that "Experiment, experiment" was the burthen of Roger Bacon (1210-1293) but not till the fifteenth century did his ideas produce their first fruits, when Leonardo da Vinci could say, "Experiment never deceives. It is only our judgment that goes astray, when we make deductions not inherent in the former." A "Renaissance" is badly needed in our research efforts in tuberculosis and it is to be hoped that just as, when "the sixteenth century dawned, and the world recovered from the storm of social trouble that had followed the pestilences of the fourteenth century, Western Europe broke out into a galaxy of names that outshine the utmost scientific reputations of the best age of Greece," so may we be privileged before long to encourage and proclaim a new Jenner or Pasteur in vaccination against this disease, if not a Von Behring or Ehrlich in its cure.

In the first presidential address of Dr. Trudeau, we read, "The scientific study of tuberculosis offers so broad a field, and one requiring observations extending over such long periods of time, that special permanent endowments solely for researches in tuberculosis, which would enable experimentation in this field to be carried on continuously through a number of years, are greatly needed." And again, "But it is mainly to laboratory research work that we must look for the solution of many of the as yet unsolved problems of tuberculosis, and for the advance in our methods of prevention and treatment."

The nations recently engaged in the World War unhesitatingly poured out their wealth to find new methods of destruction and to counter such methods of their enemies, yet not one has adequately encouraged any attempt to counter the terrible devastations of the tubercle bacillus, whose victims number hundreds of thousands yearly in almost every civilized country.

You will learn with pride that during the past year the National Tuberculosis Association for the first time in its history has attempted to

aid and encourage a few laboratory workers whose efforts to increase our knowledge have given promise. Some support has been given previously to research of a sociological nature. This is only a beginning, yet it may serve to stimulate others to give help. What more glorious service to mankind could many rich men or women be connected with than the providing of money for scientific work in tuberculosis? "But," to quote Wells again, "as scientific men tell us continually, and as 'practical' men still refuse to learn, it is only when knowledge is sought for her own sake that she gives rich and unexpected gifts in any abundance to her servants. The world of to-day is still much more disposed to spend money on technical research than on pure science. The business man of to-day still thinks of research as a sort of alchemy."

SOME INDIVIDUAL POINTS OF INTEREST

So much for my main thesis, the limitations of our knowledge and the great need of increasing it. Some points of special present or perennial interest now deserve individual mention.

Sixteen years ago, in the address referred to, Dr. Trudeau declared his faith that a method of preventive vaccination would be found. We find this same hopefulness expressed in the presidential address of Dr. Vaughan last year, as well as his hope that the National Association would be able to help such investigators financially. Colonel Bushnell also, in his recent excellent work on Epidemiology, expresses the belief that in time nature's rough and wasteful methods of protective vaccination may be replaced by a safe and scientific method of inoculation.

There has been recently in this country, and in other parts of the world, wherever there is not decided malnutrition, an unusual drop in the death rate from tuberculosis. At present we have no explanation to offer for this phenomenon. We may at least claim that part of this decline is due to the work of the National Tuberculosis Association. We have confirmation of this conjecture in the reports of The Metropolitan Life Insurance Company. By measures similar to those of our Association, this company has greatly reduced the morbidity and mortality from tuberculosis among its policy holders. It is exceedingly difficult to state to which part of the work of the Association such benefits may be due. Some will attribute them to the campaign and gospel of right living, rather than to anti-spitting laws, registration, dispensaries and sanatoria. While it is true, as Dr. Baldwin said in his presidential address of 1916, that our work, like all practical work, occasionally misplaces its emphasis, yet there can be no doubt that the lines followed in the anti-tuberculosis movement by the National Association are sound in the main. Too much effort can not be made to see that the teachings of this Association permeate and repermeate every hamlet in the country, and too much praise cannot be given the faithful sociological and medical workers who have already been the pioneers.

While the Association is teaching, it should also be learning. One of the most certainly and permanently valuable branches of our work, in my opinion, is the collection of accurate statistical data, critically analyzed, for these have hitherto been painfully wanting. The pioneer Framingham Survey has already proved not only an adventure but an achievment.

In taking the histories of intelligent patients we are more and more struck with the family infection in tuberculosis. There can be little doubt that repeated infection in childhood from a tuberculous father or mother must be more guarded against in the future than it has been in the past. Of four hundred and fifty cases examined in our recent records, over fifty per cent. give a very definite account of family exposure in childhood. We have evidence from the laboratory which demonstrates the chronicity of disease brought about by repeated irregular infection. That many children so exposed may not suffer from the later accidents of environment and strain necessary to activate their disease, is no doubt true. Yet many of such exposed children will give at least x-ray evidence of greater infection than those not so exposed.

The percentage above quoted would be far greater did all patients know the truth, and did all patients tell the truth, about their family history. Only recently a patient was brought to me whose family history was said to be negative. Later I learned from the wife that the patient's father had died of tuberculosis, but that the patient thought that if he reported this our prognosis would be graver. How often we find too that examination of the parents of patients with negative family history will disclose "carriers," who in many instances have open pulmonary tuberculosis of many years' standing.

The Oeuvre Grancher of the French, with its principle of isolating healthy children from tuberculous parents, founded on Pasteur's discoveries regarding disease in silk worms, is without doubt one of the most effective efforts ever made against tuberculosis. More and more we must protect children against repeated infection while their immunity is being developed, and the ubiquity of "carriers" must be more heeded.

Our war experience seems to have stimulated interest in one of the gaps which the rapid development of the campaign against tuberculosis has left. Vocational training and rehabilitation are at present arousing considerable discussion. Among the large groups of tuberculous patients under thirty who have not yet made a settled place for themselves in the world, industrial colonies may well prove useful. Needless to say, however, their development must be carefully considered, and they must grow and prove themselves as other factors have.

Possibly it is unfortunate that with the loss of enthusiasm of war time, we are unable to continue along the lines set by Colonel Bushnell in the handling of the Army tuberculosis problem. The routine ex-

amination of young adults, the opportunity for the study of tuberculosis occurring in all sections of the population, the special instruction in tuberculosis of large groups of medical men, and the efforts to provide adequate hospital and sanatorium facilities, are a few of the accomplishments of the army plan which were beginning to bear fruit.

However, the Public Health Service and the National Tuberculosis Association are working most earnestly to build on that experience and to fit to the civilian requirements many of the broad plans conceived and instituted.

CONCLUSION

At the end of this review of the great deficiencies in our knowledge of tuberculosis, and of the great interest and importance of rational understanding of the disease, I cannot do better than to quote from a recent address of Theobald Smith, by far the most able and eminent student of tuberculosis whom this country has yet produced:

> On account of the futurity of research it asks of us a certain amount of faith in its value and promise. It is supposed to attack the still unknown or mould the still vague and undefined. No one can promise definite results in definite directions. Results always will come after faithful work on the part of talented workers, such as will amply repay the public for the outlay, but the objective aimed at may not have been reached. We think a certain result, usually in our favor, should be reached. But our thinking so does not create a reality. If our thoughts and desires could anticipate results there would be no need of going through the elaborate and time-consuming process of getting at such results by experiment. Subsidizing research is like planting trees to be used by our successors. It is for the benefit of those who come after us, and in so far it is one of the high achievements of the present type of civilization.

This, then, is the opportunity that lies before this Association and which I wish to emphasize and insist upon in laying down the office with which you have honored me. Let us not become smug, self-satisfied, routine men. Let us keep our senses alert for new knowledge, and not close our ears to the voice that Kipling's Explorer heard:

> *Something hidden. Go and find it. Go and look behind the Ranges—*
> *Something lost behind the Ranges. Lost and waiting for you. Go!*

The author wishes to thank his co-workers, Dr. C. T. Ryder, Dr. A. M. Forster, and Dr. J. A. Sevier for valuable aid and criticism in the preparation of this address.

REPORT OF THE EXECUTIVE OFFICE FOR THE YEAR ENDING JUNE 1, 1921

The work of the National Tuberculosis Association since its last annual meeting in April, 1920, has been featured by several major events of great importance to the future of the tuberculosis campaign throughout the United States. These include the re-organization of the National Tuberculosis Association which is to be completed at this meeting; the successful result of the Christmas Seal Sale which last fall was conducted for the first time independently of the American Red Cross; the participation of the Association in the formation and work of the National Health Council; and the removal of the Association offices to 370 Seventh Avenue, New York, where with other national health agencies, the Association is developing routine office services in common and in a larger way is working toward a common understanding of and joint effort in nation-wide public health work. The increased activities of the Association incident to these changes and to the study of its work by the Committee on Re-organization have given the Association the busiest year in its history.

In order that a proper accounting for the work of the various Services or Departments may be made to the members of this Association, it seems best to divide the report into sections, summarizing the activities of the various committees and of the staff members during the year.

I. RE-ORGANIZATION OF THE ASSOCIATION

At the time of the last Annual Meeting a special committee of the Board of Directors, which has become known as the Committee on Re-organization, held a hearing at which there was a full discussion from representatives of the state tuberculosis associations with reference to changes in the organization of the National Association. This Committee was composed of Dr. David R. Lyman, Chairman; Dr. John S. Billings, Mr. Sherman C. Kingsley, Dr. George Thomas Palmer, Mr. Seymour H. Stone, Dr. Gerald B. Webb, Dr. William Charles White and Mr. George F. Canfield, ex-officio, as counselor of the Association. Several meetings were held and the most careful consideration given to recommendations regarding future policy. The Committee reported at a meeting of the Board of Directors on December 8, 1920, and the report was unanimously adopted by the Board. It was published in the monthly Bulletin of the Association for January, 1921, and therefore, no detailed account of the report is necessary here. It recom-

mended several changes in the by-laws of the Association, particularly with reference to increased representation of state tuberculosis associations on the directorate of the National Association. At the same time the Committee recommended that "Such direct representation shall be enjoyed only by those organizations which maintain at least a certain minimum standard of efficiency in their own work and of cooperation with the National Association."

The Committee attached to its report a proposed set of by-laws for the Association with amendments designed to carry out its recommendations regarding structural changes in the organization of the Association. It listed the 53 affiliated and represented associations that now have direct relations with the National Association through the Christmas Seal contract and provided that they might have representative membership in the Association and the authority to nominate representative directors, provided they have and maintain certain qualifications which, in the opinion of the Committee, would indicate at least a minimum standard of efficiency. These standards have been waived by the Board for one year from this meeting so that each affiliated and represented association may have representation on the directorate beginning to-day, with a year's time to bring its work up to the standard set.

The amended by-laws were informally approved by the Board and after further consideration and a few minor changes they were formally adopted at a meeting of the Directors on March 11, 1921. These by-laws are now in effect and under their provision the Board of Directors to be nominated to-day will consist of 50 directors at large and one representative director for each affiliated and represented association that has submitted nominations in accordance with the by-laws.

The Committee found it possible to comply only in part with its instructions to "evaluate the aims and methods" of the Association and, therefore, urged that a standing committee for the evaluation of methods and relationships should be created. The appointment of such a committee has been under consideration by the Board, but its creation has been postponed for the same reason that deterred the Committee on Re-organization from pursuing the matter further, namely, the rapid changes in our relationships with the state organizations and with other national agencies.

II. NATIONAL HEALTH COUNCIL

Although the coordination of national health activities has been discussed for years, the creation of the National Health Council was the first actual accomplishment toward this end, and the National Tuberculosis Association takes pleasure in the fact that it was one of the charter members. The Council was formally organized on December 10, 1920, with the following constituent members:

American Public Health Association.

American Red Cross.
American Social Hygiene Association.
Conference of State and Provincial Health Authorities of North America.
Council on Health and Public Instruction of the American Medical Association.
National Child Health Council.
National Committee for Mental Hygiene.
National Organization for Public Health Nursing.
National Tuberculosis Association.
United States Public Health Service. (Conference or Advisory Member).

There had been many preliminary conferences, formal and informal, leading up to the organization of the Council and in most of these the National Tuberculosis Association had been represented. The Association is gratified that one of its staff members, Dr. Donald B. Armstrong, was selected to make a preliminary study of the desirability of forming such a Council and of the type of organization to be established.

The proposed or initiated functions of the Council, approved to date, are:

1. An information bureau of special service to members.
2. A health legislative bureau on national and state legislation.
3. A statistical bureau.
4. The development of health educational material.
5. Periodic joint conferences.
6. The coordination of health activities.

The representative of the National Association on the Council is the Managing Director with Dr. James Alexander Miller as alternate.

III. REMOVAL OF OFFICE

Early in 1921 a movement was started to bring together the constituent organizations of the National Health Council that had their executive offices in New York City. This led to the rental of two floors of the large building at 370 Seventh Avenue and the removal to this location during April and May of the American Social Hygiene Association, the National Committee for Mental Hygiene, the National Organization for Public Health Nursing with its two allied nursing associations, and the National Tuberculosis Association. These agencies occupy the fifteenth floor, and the office of the National Health Council is on the sixteenth floor.

In order that the plans for the co-operative renting arrangement and for certain common services might be expedited, a Common Service Committee was created, representing these five agencies. The autonomy of each participating agency is preserved, but it has already been found possible to have such joint facilities as centralized telephone service, conference, exhibit and projection room, library service, stock

rooms, shipping, rest room, and reception service. Others are in contemplation, such as a joint multigraphing and addressing plant, and a combined motion-picture service. The Committee is closely allied to the National Health Council and it is anticipated that many of the services now performed by this Committee may eventually be rendered by the Council itself.

The American Public Health Association, another constituent member of the Council, has moved its offices to this building from Boston and in order that sufficient space may be reserved for future expansion, short time leases have been given to a few other health and welfare organizations, some of which are not national in character. A cordial invitation is extended to the delegates to visit the office of the Association and the other organizations at 370 Seventh Avenue.

IV. NATIONAL CHILD HEALTH COUNCIL

The National Association has also become a member of the National Child Health Council and is represented by the managing Director and Mr. William H. Baldwin. This Council is composed of the American Child Hygiene Association, the Child Health Organization of America, the National Child Labor Committee, the American Red Cross, the National Organization for Public Health Nursing and the National Tuberculosis Association.

V. ADMINISTRATIVE SERVICE

A change in the administration of the office was inaugurated on November 22, 1920. Mr. Jacobs, who for a number of years had borne the burden of the administrative detail of the office and of the Association, relinquished that phase of the work to devote himself exclusively to the Publicity and Publications Service. He was given the title of Publicity Director. Mr. Hopkins, who had served for the last two years as Supervisor of Field Service, took over the administrative details heretofore handled by Mr. Jacobs with the title of Administrative Secretary.

With the increased work of the staff and the recent increases in the amounts of Seal, Crusade and other supplies ordered by state and local associations, it will be understood that the administrative side of the work requires increasing attention. During the year it has been the endeavor of the Association to increase the business efficiency of the office. Mr. S. M. Sharpe was placed in charge of the business section of the office in May, 1920 with the title of Business Manager. He is responsible for the business services of the office, including the purchase and selling of supplies, the bookkeeping and the entire clerical work. During the year continuous effort has been made to improve the routine handling of accounts. The staff was greatly shocked at the sudden death of our Auditor, Mr. F. W. Coriell, on February 3, 1921. The

Executive Office desires to record its lasting appreciation of the work which Mr. Coriell performed for about two years in changing and expanding the bookkeeping system so that it would meet present needs. Since February Mr. Sharpe has taken personal charge of the bookkeeping department and in consultation with the auditors has made additional improvements in the system. In this connection the invaluable assistance of our Treasurer, Mr. Henry B. Platt, should be noted. His wise counsel during the last year has made it possible for the Association to keep a more accurate watch on its financial condition.

With the increase in the staff, which now numbers 26 administrative members and 32 clerical members, the office at 381 Fourth Avenue became overcrowded and it was with considerable relief that the removal was made to our present quarters on April 11th. Improved office conditions have resulted and it is hoped that still further advantages may be gained from our relations with the Common Service Committee. The work of this Committee has necessitated several changes in office routine, but all of these have been made with a minimum loss of time and confusion.

1. Revolving Fund

One of the most important functions of the Association is to act as a clearing house for the purchase of certain standard supplies for resale to state and local associations. Because it is impossible to use current funds for this purpose, the Board of Directors has authorized a Revolving Fund, which it is hoped will reach a minimum of $50,000. Towards this fund, the Chicago Tuberculosis Institute has subscribed the first $1,000. The Board of Directors has decided that the sum of $10,000 shall be set aside for this purpose from the funds now at hand. Further additions to the Revolving Fund will be sought from other sources.

VI. MEDICAL SERVICE

The Medical Service has been exceedingly busy during the past year. In fact, the demands upon this department of the National Association's activities have been so great that it has been found necessary to engage the services of another physician to assist in the undertaking of certain special studies, and to do general field service. Dr. Edgar Thompson Shields of Los Angeles has accepted the offer of this position of Medical Field Secretary and begins his duties about June 15.

1. Rehabilitation of Tuberculous Ex-Service Men

Perhaps the most significant activity of the Medical Service is that in connection with the Federal Government in the development of its program for the rehabilitation of disabled ex-Service men. It was thought that the National Tuberculosis Association's work in this re-

spect would gradually decrease, giving the staff members greater time for the development of other programs. On the contrary, the demands in this direction have steadily increased. The complex problems of rehabilitation have become much greater than was probably foreseen by any of the departments of the Government. The problem of tuberculosis being greater than any of the others, with the possible exception of neuro-psychiatry, has led several of the bureaus of the Government to call upon the National Association for assistance in numerous ways. Dr. Pattison and Mr. Kidner have given a large measure of their time to gathering data, making inspections and surveys, and giving general counsel on many details which were naturally within their knowledge because of their connection with the National Association and their wide travels in the field.

2. *Advisory Service to Governmental Departments*

They are acting in an advisory capacity to the Bureau of War Risk Insurance, the U. S. Public Health Service, the Federal Board for Vocational Education, the National Home for Disabled Volunteer Soldiers, and are also working in close cooperation with the American Legion in its study of the problems of the disabled soldier, Dr. Pattison being an advisory member of the Committee on Hospitalization of the Legion.

With the very able assistance and counsel of Dr. A. H. Garvin, of Detroit, the Medical Service made an inspection of several branches of the National Home for Disabled Volunteer Soldiers, located at Johnson City, Tenn.; Dayton, O., and Hot Springs, S. D. As a result of their report, the Board of Managers of the National Home converted the branch home at Johnson City into a 1000-bed sanatorium. With unusual rapidity of action, the Board of Managers had cure porches added to the existing pavilions, built a nurses' home and residences for physicians, and made other alterations costing some three or four hundred thousand dollars. They also added equipment and secured the services of a trained personnel, the Medical Superintendent being Dr. G. L. Bellis, of Muirdale Sanatorium, Wauwatosa, Wis. There are now more than 700 men being cared for in this institution, and when sufficient medical and nursing personnel have been secured the sanatorium will be one of the finest of its kind in the country.

3. *Assistance to Committee on Hospitalization*

With the Bureau of War Risk Insurance, the National Association has cooperated in studying disability ratings, problems of discipline, legislation for reorganization and plans for increased hospitalization. It is not news to the members of this Association that the Secretary of the Treasury, Mr. Mellon, appointed a committee to counsel with him in developing a program and plans for the expenditure of eighteen mil-

lion six hundred thousand dollars, appropriated by Congress for providing new hospital facilities. Dr. William Charles White was made Chairman of the Committee, with Dr. Frank Billings of Chicago; Dr. Pearce Bailey, of New York, and Dr. J. G. Bowman, Chancellor of the University of Pittsburgh, as associates. Dr. White and Dr. Billings are both Directors of the Association.

The Committee requested the National Association to detail Dr. Pattison and Mr. Kidner for service in gathering data. After a most intensive study of two months, ten million nine hundred thousand dollars was allocated for tuberculosis sanatoria in various parts of the United States, and seven million three hundred and fourteen thousand dollars for neuro-psychiatric institutions. Too much cannot be said in praise of the manner in which Dr. White's Committee met and withstood the pressure of many conflicting interests. Having determined its function and developed its method of procedure, it pressed steadily toward the end in view, and if the program outlined is followed it will have procured for the disabled soldiers the greatest possible increase in facilities possible under the appropriation.

f. Construction and Equipment Standards

Coöperating with the U. S. Public Health Service, the National Association has assisted in developing standards of diagnosis and treatment, and Mr. Kidner, particularly, has given a great deal of time to studying suitable plans for hospital construction, and has written a valuable monograph setting forth in detail the type of construction and equipment necessary to meet the Class "A" standards of the American Sanatorium Association. This is the most complete work that has yet been done on the subject, and it is now in the course of publication by the Public Health Service.

Mention might be made also of the active work of Dr. F. C. Smith, of the Public Health Service, in developing the sentiment for tuberculosis wards in general hospitals. It will be recalled that the National Tuberculosis Association passed a resolution in 1916 urging tuberculosis wards in general hospitals. Dr. Smith secured further endorsement of this proposal from the Trustees of the American Hospital Association.

The Medical Service has also made a number of hospital surveys for the Public Health Service. One of the most important of these was the inspection by Dr. Pattison and Mr. Kidner of the Sanatorium at Markleton, Penn., which had been leased by the Public Health Service. Their findings indicated the absolute unsuitability of the institution for the purposes of a sanatorium, and they recommended its abandonment at the earliest possible moment. Great pressure by private interests was brought to bear upon Government officials and the Congress to continue this institution. The Secretary of the Treasury, therefore, appointed a special committee, composed of Dr. William H. Welch, Dr. Thomas Mc-

Crea and Dr. Gordon Wilson. Their findings corroborated the findings of our Medical Service and were even more condemnatory. The institution was immediately closed.

The National Tuberculosis Association is in constant communication with the American Legion, which has stated frequently that it is leaning heavily upon this Association in its study of the problem of tuberculosis, as it depends upon the National Committee for Mental Hygiene in its study of the problems of neuro-psychiatry. Copies of memoranda, proposed legislation and complaints regarding treatment are sent to the National Association for opinion. Investigations for the Legion have also been made.

Cooperation with the Federal Board for Vocational Education is less active than it has been in the past, for the Federal Board has more nearly completed the development of its program. However, the passage by Congress a few months ago of a law providing for the vocational rehabilitation of men crippled in industry by disease or accident has given new impetus and direction to the work of the Board. Again the problem of tuberculosis is the largest which presents itself for consideration. Mechanical disabilities, such as amputations, ankyloses, etc., present very minor difficulties for vocational advisement and placement, as compared with the problem presented by respiratory, cardiac and other chronic diseases.

5. *Study of Tuberculosis in Industry*

The Federal Board has sought the coperation of the National Tuberculosis Association and has accepted as eminently practicable a program of research and placement offered by Dr. Pattison. It has asked the National Tuberculosis Association to cooperate in the research and has appropriated ten thousand dollars a year for three years, provided the National Association supplies a like amount, since the minimum cost of the study is estimated to be twenty thousand dollars per year. The Directors of the National Association have unanimously approved of the plan, provided the funds can be secured outside of the present resources of the National Association. The proposal has been presented to several of the foundations, and it is hoped that funds will be forthcoming to make it possible to undertake this study of the health hazzards of industry as they relate to tuberculosis. It is believed to be one of the most important pieces of work ever presented to the National Association.

In addition to the work with departments of the Federal Government, much has been accomplished in the Medical Service in many other directions. There have been surveys of proposed sites for new sanatoria and of existing municipal, state and county institutions. A survey has been begun at the request of the New Jersey State Department of Institutions and Agencies of the whole tuberculosis problem in New Jersey, and this will probably be completed during the summer months.

6. Home Treatment

At the last meeting of the American Sanatorium Association at Rochester, N. Y., the Supervisor of the Medical Service presented for the consideration of the American Sanatorium Association a proposal for an experiment in more closely supervised home treatment following a minimum period of sanatorium care. The Association appointed a committee of three to study the proposal and to report to the meeting of the Sanatorium Association being held this week. If the American Sanatorium Association recommends the proposal, and we understand that the Committee's report is favorable, the National Association will present the plan to the state and local associations at the sectional conferences. It will offer them a fertile field for service.

7. Nursing

Miss Marshall's work in the Nursing Service has been particularly directed to advancing the education of nurses in the subject of tuberculosis. The National Association has published an outline of ten lectures on tuberculosis for nurses, occupational aides and social workers, which was jointly prepared by Dr. Pattison and Miss Marshall. This outline was developed at the request of the Superintendent of the Army Nurse Corps, and is being used in at least one of the Army hospitals. It is also being rapidly introduced into training schools for nurses.

Through Miss Marshall's activities the National League for Nursing Education, which is the standard-making body for the fundamental training of nurses, has recommended that every accredited training school for nurses give its pupils both theoretical and practical instruction in tuberculosis nursing. It also appointed a sub-committee to its Educational Committee, which is preparing the standards and outlines for the teaching of both phases of this subject. In order to carry out this recommendation, hospitals will either have to open wards for the care of tuberculous patients or affiliate with a tuberculosis sanatorium. This offers an opportunity for cooperation to our affiliated state and local associations. An outline for a post-graduate course in tuberculosis nursing has also been recommended to the Public Health Service and a director suggested for the course.

Miss Marshall has attended numerous conferences and conventions of nurses and has carried on extensive correspondence with state supervisors of nurses, assisting them in developing tuberculosis programs. She is now at work on a system of records and reports for tuberculosis clinics, which we hope will simplify the study of results obtained in clinics.

The correspondence of the Medical Service in general is becoming quite voluminous. Inquiries of great variety, directly and remotely connected with the subject of tuberculosis, reach the office from every State and from foreign countries. Cooperating with the library, research

and statistical service of the National Association, every effort is made to reply to these inquiries fully and helpfully.

VII. PUBLICITY AND PUBLICATIONS SERVICE

As a result of the withdrawal of Mr. Jacobs from the administrative responsibility of the Association, the Publicity and Publications Service was reorganized last fall. Mr. Jacobs became head of the service with the title of Publicity Director. Mr. Eaves, as a member of the service, took the title of Campaign Secretary. Miss Williams and Miss Cole, the other members of the service, have the title of Assistant Publicity Secretary.

In general, the Publicity and Publications Service conceives its function to be, first of all to convey information and suggestions to the general public; secondly, to inform the field, particularly the secretaries, of what is going on that is of vital interest to them; and thirdly, to keep the staff of the Association intimately acquainted with the work of the office and of the field in general.

1. Routine Publicity

In accordance with the policy approved by the state associations, the National Tuberculosis Association has, during the past year, refrained from contact directly with the newspaper press of the country, with the exception of "spot news," which has usually been carried through such syndicates as the Associated Press or the United Press. We have furnished state association releases at periodic intervals to state organizations.

In the field of national magazines, class journals, house organs, etc., the Publicity Service has endeavored to establish and maintain direct contact. A considerable number of stories is being furnished for publications of this character.

2. Publications

a. American Review of Tuberculosis.

The American Review of Tuberculosis now enjoys the enviable reputation of being in volume of circulation and in other respects one of the leading scientific medical publications in the country and the foremost review on tuberculosis. Our circulation at the present time is approximately 1,500, and in addition to this nearly 200 copies are being distributed each month. The Review, as has been anticipated, is operating at a loss amounting in 1920 to about $7,000.

b. Journal of the Outdoor Life.

The Journal of the Outdoor Life in the fall of 1920 confronted a serious situation with reference to cost of production that threatened for a time to shipwreck this enterprise. By heroic effort, however, the

JOURNAL has been brought again to a basis where it is paying for itself, and it is expected that the present calendar year will be completed without a deficit. During the past year the following editorial staff for the JOURNAL OF THE OUTDOOR LIFE has been created: James Alexander Miller, M.D., Editor-in-Chief; H. R. M. Landis, M.D.; Lawrason Brown, M.D.; Fred H. Heise, M.D.; Charles L. Minor, M.D.; Allen K. Krause, M.D.; Philip King Brown, M.D.; A. W. Jones, Jr.; Homer Folks, George Thomas Palmer, M.D.; John Tombs, Charles J. Hatfield, M.D.; Philip P. Jacobs, Ph.D., Managing Editor.

c. BULLETIN.

During the past year readers of the BULLETIN were asked whether the BULLETIN should be allowed to die and they vigorously responded in the negative. The Monthly BULLETIN apparently fills a real need, serving as a house organ or a technical publication dealing primarily with methods and programs. It now has a circulation of approximately 12,000 per month. The BULLETIN is furnished free.

d. TRANSACTIONS.

The annual TRANSACTIONS for the 1920 meeting made a volume of 628 pages, costing the Association about $2.00 per volume to print. This volume is furnished free to members who request it.

e. Other Publications.

During the past year the Publicity and Publications Service has issued the following publications:

"An Outline of Lectures on Tuberculosis for Nurses, Occupational Aides and Social Workers with Bibliography,"
"Organization for Prevention and Control of Tuberculosis,"
"In This Sign,"

and a number of other smaller publications.

3. Christmas Seal Campaign

The Christmas seal campaign of 1920 resulted in a total sale of approximately $3,650,000, a total slightly below the 1919 total. Considering the serious financial depression of the country as well as the fact that this was the first year of an independent tuberculosis seal, it is proper to conclude that the total of 1920 is equivalent to a considerable increase under normal circumstances over the sale of 1919. The Publicity Service was responsible not only for the preparation of supplies and the general set-up of the national campaign, but also for the general outline of publicity incident to the campaign. It is gratifying to record here the generous response of several hundred magazines, trade journals and house organs to our request for free advertising, articles and editorial comment. The coöperation of these publications was unquestionably a strong feature in the success of the campaign.

For the 1921 campaign encouraging progress has been made. Con-

tracts for practically all of the printed matter have been let and the whole supply question is well in hand.

The arrangement employed for the first time last year whereby the state associations purchased their supplies outright and paid a flat percentage of 5 per cent. has worked out satisfactorily to the mutual advantage of the National and state associations. It is planned to continue this arrangement during the coming year.

4. Institutes

During the past year two institutes for the training of tuberculosis workers have been held under the direction of Mr. Jacobs at the New York School of Social Work. Following this meeting the ninth institute will be held, and for the first time an advanced course of instruction will be attempted for those who have attended previous institutes or have had definite experience in the tuberculosis field.

5. Copyright of the Double-Barred Cross

It is gratifying to report that the United States Patent Office has granted the application of the National Tuberculosis Association for a trade-mark registration of the double-barred cross as the official emblem of the Association for use on pamphlets, circulars and printed books. The Association under this registration may allow affiliated agencies to use the emblem. Many permits for such use have already been granted. We are advised that arrangements will be made for the granting of permits by the representative directors of the Association, so that the necessity for making application and submitting proposed printed matter to the executive office can be avoided.

6. Special Features

The Publicity and Publications Service largely through the work of Miss Williams and Miss Cole have developed a number of special features of interest during the past year.

a. Marionettes.

The revival of interest in this country in the marionette as a theatrical enterprise has been capitalized by the National Tuberculosis Association through the preparation of a small standard marionette theatre which can be easily operated by any amateur and which is well adapted to health education. A play for the marionette theatre dealing with the Modern Health Crusade has been written by Miss Williams and Mr. Dondo, the inventor of the theatre. A number of theatres have been sold to state associations and others.

b. Tiny Tim's House.

As the result of a suggestion by Miss Osborne, Miss Williams and Miss Osborne, together with other members of the staff, have developed another theatrical venture which we have called Tiny Tim's House. This is simply a cardboard theatre which we have been able to standard-

ize for the small price of $2.00. An interesting play entitled "The Champion," dealing with the subject of foods, has been written by Miss Williams. The characters in this theatre are vegetables, such as potatoes, onions, spinach, carrots, etc. The operation of the theatre is similar to that of the marionette theatre, but with a great deal less expense and somewhat more adaptability. It is anticipated that these theatres will be in great demand in schools and elsewhere. Both Tiny Tim's House and the Marionettes are being demonstrated in the exhibit in connection with this meeting.

c. Health Clown.

As a result of a widely-expressed demand, the Association has added to its staff Mr. Ray L. Law, who will act in the capacity of health clown with the title of "Humpty-Dumpty." The services of "Humpty-Dumpty" may be obtained at a moderate fee, through state associations so far as possible. Mr. Law will supplement and emphasize the work of the Modern Health Crusade, teaching through his work the proper use of the toothbrush, washing of hands, taking of baths, sleeping with windows open ten hours each night, and other similar lessons. His services will be available immediately after this meeting.

d. Motion Picture Service.

The motion picture service during the past year has made 450 bookings and has sold 59 films. At the present time we have in our service 19 films of ten different subjects for loan. As the result of a general demand, the Association has just produced a new motion picture dealing with the Modern Health Crusade. Arrangements have been made for the production of another picture dealing with the hopeful or cure side of tuberculosis which will be released about November 1st.

e. Loan Service.

The Loan Service has been in great demand during the last year. In addition to motion pictures, the Loan Service provides scrapbooks of suggestions, photographs, cuts and other material.

f. Pageant.

The preparation of the pageant entitled "The Spirit of the Double-Barred Cross," to be shown at this meeting, has been entirely the work of Miss Williams and Miss Cole. The Association is deeply indebted to Mr. Eugene Roder and Miss M. T. Glynn for their expert services in connection with the staging and direction of the pageant.

g. Exhibit.

The exhibit at the annual meeting has also been under the direction of the Publicity and Publications Service. An effort has been made for the first time to demonstrate methods of anti-tuberculosis work.

7. Membership

During the past year the membership records of the Association have been completely reorganized. While the number of members on the list

at present (about 3,500) is somewhat smaller than reported a year ago, the condition of the list is decidedly better than at any previous time in the Association's history. An effort has been made during the last year to increase the number of donations, particularly from labor unions. The United Brotherhood of Carpenters and Joiners of America and the Brotherhood of Railway Carmen of America have each contributed $500 as a result of this effort. Further contributions from similar sources are anticipated.

VIII. MODERN HEALTH CRUSADE

The growth of the Crusade movement during the last year has been marked. Geographically, it has extended to Czecho-Slovakia. Translations of the National Association material for adaptations are now in use both there and in France. The Crusade is in operation in China, Canada and some Spanish-American countries.

In our own country, the Crusade, a nation-wide movement a year ago, has grown intensively. Its official recognition as a system of education has been gratifying. The Crusade has now been adopted on a state-wide basis for the schools of eight states, either as an obligatory or as a recommended method of teaching hygiene. Manuals issued by the state educational authorities, as, for example, in the case of Maine, Alabama and Kentucky, give expositions of the Crusade with reference to our material for the guidance of teachers. Such large cities as St. Louis and Detroit have introduced the Crusade in their schools.

It has been demonstrated by successive years' experience that interest in the Crusade may be sustained and that the movement need be considered in no sense a fad. Further endorsement of the Crusade, of a kind of practical value to us, is the increased use of public school funds for the purpose of Crusade supplies. Printed matter and all forms of insignia are purchased with school funds and in at least one state the purchase is prescribed for pupils in like manner as their books.

The demand for a progressive program from grade to grade is being met by the use of health chore records for three ages of pupils, and by the Round Table or advanced program of the Crusade. While the optional character of all Crusade work, beyond the keeping of one set of chores, has been emphasized, schools in several states have been interested to meet the various tests for all-around physical fitness required of Knights of the Round Table.

There has been increasing participation in the national tournaments of the Crusade, four of which have now been conducted by the National Association.

Mr. DeForest and associates in the Crusade service have made a diligent study throughout the year, with a view to improving the Crusade. In the material for the next school year, the reward for Page has been eliminated and the chore records reduced by one-half their size and at

the same time printed in larger type. It is felt that these forms of simplification will be of great benefit to the Crusade.

The Association has been fortunate in receiving suggestions for improving the Crusade from many workers and the sub-committee of the Committee of Eleven. Additional publications have been recommended which we have been unable to bring out from lack of funds and time to test out. By suggestion of the National Advisory Council for the Crusade, the policy of the office has been to go slowly in multiplying material for teachers to handle. It is the desire of the executive office, however, to have everything forthcoming that will be of assured help in making the Crusade of maximum service in the schools.

1. National Advisory Council

The National Advisory Council for the Crusade, formed during the year, is composed of men and women who are experts in various phases of hygiene education in hygiene and school needs. The acceptance of places on our Council by these persons, most of whom are nationally known, speaks of the high esteem in which the Crusade is held. The National Council has given valuable advice to our Association, both in meeting and by correspondence. A meeting of the Council was held at Atlantic City in March.

Last December Mr. DeForest accompanied Commissioner Claxton, of the U. S. Bureau of Education, at his invitation, on a continental tour, to speak on the relation of education to health. He made addresses at nine citizens' conferences on education, arranged for groups of states.

The Association was represented at the two meetings of the National Educational Association. At its Salt Lake City meeting the Utah and Idaho associations conducted a program for the National Association. At its convention for superintendents at Atlantic City, the Crusade pageant presented by public school children and conducted by Mrs. Cora E. Grant, through the coöperation of the District of Columbia Association, gave particularly valuable publicity to the movement.

Plans have developed for making the field service of the Crusade department more effective. Following this meeting, Miss Osborne will conduct Crusade institutes for one, two or three days, with the coöperation of several state associations, at various cities as far west as Oregon.

IX. FIELD SERVICE

At the time of the last annual meeting, the field service consisted of a Supervisor and six Regional Secretaries. The regional plan had been adopted following the suggestion of the Mississippi Valley Conference on Tuberculosis for a service of this type in that section of the country. It was inaugurated after most careful discussion by the Board of Directors, but was considered as an experiment that seemed to promise excellent results for the money expended.

In May, 1921, a special committee of the executive committee, after

a careful study of the estimated income and expenditures of the Association for the balance of the year, found it necessary to recommend a reduction in the budget. In addition to some general economies it was decided to close the regional offices. Mr. George Everson, who had resigned in April, ended his services with the closing of the Portland, Oregon, office in June. The southwestern office in Albuquerque was closed June 1st, Mr. John Tombs having already been given a leave of absence on account of illness. The southern office in Atlanta was closed on July 1st, and Mr. Murray A. Auerbach resigned to accept a position with the Gulf Division of the American Red Cross. Mr. Arthur J. Strawson continued to reside in the Mississippi Valley, although the Indianapolis office was closed. The office for the New England states, which had been located with the main office, was closed in July and Mr. Leet B. Myers resigned to accept a position with the National Child Welfare Association. The Philadelphia office was closed in June and Mr. Paul L. Benjamin soon afterwards resigned to take a position on the SURVEY, but was able to give part-time service to the Association until January 1st.

It is gratifying to note that the Committee on Reorganization has indicated its belief in the value of this experiment and has not only expressed regret at its discontinuance, but urges its resumption, especially for those sections of the country which definitely approve of and have indicated their desire for this service. The committee states: "The credit for this satisfactory showing must be given to the men in whose hands this work has been placed, and we feel it to have been a very great pity that the finances of the Association compelled the very marked curtailment of this service at a time when the promising field force at work had just developed sufficient training in this field to be able to demonstrate just what might be their real value."

During the fall, the Field Service devoted almost its entire attention to the seal sale. Mr. Hopkins started in August on a trip which permitted field work in 14 states, and included attendance at the Mississippi Valley Conference on Tuberculosis, the Southwestern Tuberculosis Conference, the Southern Tuberculosis Conference and the annual meeting of the American Public Health Association. He also discussed the seal sale with the representatives of eight southern states at a meeting at Atlanta. Mr. Strawson covered all of the Mississippi Valley and some of the Western and Northwestern states during the campaign. Mr. Benjamin was of assistance in several of the North Atlantic states and visited each New England state. Mr. William B. Buck was added to the field staff for temporary service in the West during the latter part of 1920.

Other members of the staff also have made numerous trips to state and local associations and to institutions. At least two members of the staff attended each of the sectional conferences which were held last fall in San Francisco, Cheyenne, Duluth, Jacksonville, Richmond, Va., and Manchester. The managing director made a trip to the Pacific Coast in

September, attending the Northwestern and Southwestern conferences, and the meeting of the American Public Health Association.

Mr. Strawson was appointed Supervisor of Field Service on February 1st, succeeding Mr. Hopkins. In addition to services to the states through correspondence and his coöperation with the other services of the Association, he has made two trips of some length, one through the Southern states and the other to several Mississippi Valley and Southern states.

In accordance with the recommendation of the Committee on Reorganization, the budget of the Association this year provided for two field secretaries. The appointment of Dr. Shields, as already noted, was made in lieu of one secretary under the Field Service. Although Dr. Shields is attached to the Medical Service, it is expected that a part of his time will be devoted to field service of a medical character.

Under Mr. Strawson's direction the Field Service has undertaken the development of a list of special consultants to furnish expert service to state and local associations at small expense and thereby to supplement the limited field service of the National Association. Since the decrease in the personnel of the general field service last summer, an effort has been made to make the greatest possible use of every staff member of the Association on each trip from the executive office. Despite this, however, it has been found necessary to refuse requests for service and it is hoped that at least one more secretary can be appointed at an early date.

Mr. Strawson has also given considerable time to the matter of personnel for associations and institutions in conference with representatives of the National Social Workers Exchange, which renders employment service to the Association under contract.

X. RESEARCH, STATISTICS AND LIBRARY

In addition to Miss Whitney's study of the problem of the indigent migratory consumptive, mentioned elsewhere, the statistical, research and library facilities of the Association have been useful during the year in several important services. At the suggestion of Dr. Louis I. Dublin, statistician of the Metropolitan Life Insurance Company, and with the official approval of the American Sanatorium Association, a statistical study of patients discharged from sanatoria has been undertaken. The plan of the study has been worked out with Dr. Dublin's counsel and advice, and records are now being secured for the year 1920. The study will seek to determine the mortality of patients after leaving the sanatorium, the physical condition of the living, and their social and economic status. All sanatoria have been requested to coöperate, and to date 90 have offered to obtain the information from their patients. The Bureau of War Risk Insurance of the Treasury Department has also agreed to submit data regarding its patients as soon as possible.

Miss Josephine McK. Stults, our librarian, resigned in December and Miss Isabel L. Towner was appointed in her place, beginning January 3d.

Under the plan of the Common Service Committee for joint library service, Miss Towner has been transferred temporarily to the committee. Under its auspices a recataloguing and classifying of our library material will be undertaken. A cumulative index of the Transactions of annual meetings has been completed, and an index of the monthly bulletins is in preparation.

XI. RELATIONS WITH STATE TUBERCULOSIS ASSOCIATIONS

In addition to the standards for state tuberculosis associations already mentioned, the Committee on Reorganization urged the following policy:

"The Board of Directors of the state associations should be elected by their general membership and the state associations should give to such of their local associations as maintain a certain standard of efficiency the same right of direct participation and representation in their councils which the National Association is now according to the state organization."

This recommendation and the need for changes in the constitution and by-laws of state tuberculosis associations, in order that they may meet the requirements specified in the by-laws of the National Association, has led to the adoption of changes in several states. The willingness to make necessary changes at an early date is to be commended and leads to the hope that each affiliated and represented association will meet the minimum standards by the time of our next annual meeting.

Early in the coming year it will be necessary for the National Association to begin a study of the organization and work of the state associations to determine whether they are maintaining the qualifications necessary to the nomination of a representative director on our Board of Directors at the next annual meeting. It is to be noted, however, that three matters included in the standards have already been taken up by the National Association with encouraging results. These relate to annual audits, a budget and program and a report of the year's work. In January, 1920, the executive committee of the National Association passed a resolution requesting "all state and local agents for Christmas Seals to have an audit of their books by a certified public accountant for the calendar year ending December 31, 1919, and for each calendar year thereafter." This resolution was communicated to the state associations and discussed with them during field visits of staff members. As a result, the executive office had information on January 1st of the present year that 45 states had arranged for an annual audit. At the conference of the executive office with the executives of affiliated and represented associations last January, it was unanimously voted that each association will hereafter send a copy of its annual audit to the National Association. Our records now indicate that out of these 53 agencies 47 have arranged for the audit.

The principle of a budget and program of work to be submitted to the

National Association was established in 1919, when such records were required in order that there might be a full accounting for the expenditure of the appropriation from the American Red Cross. For the calendar year 1920, a budget and program was requested on forms submitted to and approved by the state associations in January of that year. Thirty-five of the "affiliated and represented" associations submitted budgets and programs which were formally approved by the National Association. Eight other associations submitted information which was incomplete and was not given formal approval. Only ten associations failed to furnish information. For 1921 it is hoped to secure these data from all states. Most of them have sent the required information to the executive office and others have promised to do so shortly.

By vote of the executives of the state associations a quarterly financial statement was decided upon for the calendar year 1920. This information was received from 41 states. In addition, nine states have submitted an annual report of receipts and expenditures, and at the present time only one quarterly statement from each of three states is missing. These figures are a most encouraging indication of the earnest desire of state tuberculosis associations to conduct their affairs on strict business lines, so that the public may be assured of the fullest accounting for funds, of the complete record of accomplishments, and of wise planning yearly for the activities about to be undertaken.

XII. INTERNATIONAL UNION AGAINST TUBERCULOSIS

A preliminary meeting to form a new International Tuberculosis Conference was held in Paris last October. The United States was represented by the President of the National Tuberculosis Association, Dr. Gerald B. Webb, and by Dr. Charles L. Minor, Dr. Paul A. Lewis, Dr. Stephen J. Maher, Dr. Bernard Wyatt, Dr. Edward J. Lynch and Mr. Bolton Smith.

Two reports were presented by the delegates from the United States. The first, prepared by Dr. Pattison, of the staff of the National Tuberculosis Association, dealt with the mortality and morbidity from tuberculosis — together with the status of American thought on "Infection in Tuberculosis." The second, dealing with the History and Organization of the Tuberculosis Campaign in the United States, was prepared by Mr. Jacobs, and has since been printed as one of the Association's pamphlets.

The conference resulted in the formation of the International Union Against Tuberculosis, and its first meeting will be held in London, July 26th-28th, with the British National Association for the Prevention of Tuberculosis acting as host. Sir Robert Phillip, Vice-Chairman of the Council of the British Association, and President-elect of the International Union, has announced that the three principal addresses are to be made by representatives of France, England and the United States. Monsieur Leon Bourgeois is expected to represent France, and Hon. A. J. Balfour to represent England. The National Tuberculosis Asso-

ciation takes great pleasure in announcing that its official representative to the International meeting will be Col. George E. Bushnell, U. S. Army, retired. He will address the Union on the subject of "The Rôle of the International Union in the Prevention of Tuberculosis." Other delegates appointed by President Webb, who have signified their intention of attending the meeting, are: Dr. Charles L. Minor, Dr. H. R. M. Landis, Dr. Ray Matson, Miss Mary S. Gardner, Dr. Linsly R. Williams, and Mr. Arthur R. Kimball.

It is gratifying to announce also that Dr. Webb, who was elected at the Paris meeting as a member of the executive committee, will attend.

XIII. INVITATION FROM MEXICO

Through Dr. Philip King Brown, Vice-President of the National Association, an invitation to visit Mexico has been received from Dr. Gabriel Malda, Chief of the Department of Public Health of the Republic of Mexico. The invitation comes in the name of the President of the Republic and suggests that the visit be arranged in connection with the annual meeting of the National Tuberculosis Association in 1922.

XIV. SPECIAL COMMITTEES

The Association is to be congratulated on the valuable services rendered during the year by several of its special committees.

1. Colonization Committee

Not a little labor has been performed by the Medical Service in gathering data for the Colonization Committee authorized by the Association at the St. Louis meeting last April. This committee is composed of Dr. A. M. Forster, chairman; Dr. Victor C. Vaughan, Dr. Martin F. Sloan, Mr. James P. Munroe, President of the Federal Board for Vocational Education; Dr. Elwood Mead, of the College of Agriculture, University of California; Mr. Gideon H. Wells, architect of this city; Mr. Ernest M. Gilbert, of Reading, Pa., a consulting engineer for several public utility corporations; Mr. Fred M. Stein, a director of the New York City Tuberculosis Association, and Chairman of the Workshop Committee; Mr. W. Frank Purdy, President of the Art Alliance of America and Manager of the Department of Sculpture of the Gorham Company. A meeting of this committee is being held in connection with the annual meeting.

2. Committee on Medical Research

Another recommedation of the Committee on Reorganization was followed in the appointment of a Committee on Medical Research, consisting of Dr. William Charles White, Chairman, Dr. Paul A. Lewis and Dr. Allen K. Krause. Since June, 1920, this committee has given close study to the various fields of research which could be aided materially with small amounts of money. At the recommendation of the committee,

the budget of the Association this year contains an appropriation of $20,000 for medical research. Thus far disbursements have been made on recommendation of the committee for the following studies:

Dr. Esmond R. Long, Department of Pathology of the University of Chicago, for a study of "Fundamental Problems in the Nutrition of the Tubercle Bacillus."

Dr. William Snow Miller, Department of Anatomy, University of Wisconsin, for a study of "Anatomy of the Lungs."

Dr. H. K. Dunham, Department of Pediatrics, University of Cincinnati, for a study of "X-Ray Normals."

Dr. H. K. Pancoast, X-Ray Laboratory, University Hospital, Philadelphia, for a study of "X-Ray Normals."

Dr. F. H. Baetjer, Johns Hopkins Hospital, Baltimore, for a study of "X-Ray Normals."

Dr. Ernest L. Walker, University of California, for a study of "Chaulmoogra Oil."

The program of this meeting will include preliminary reports of these gentlemen.

3. Study of Indigent Migratory Consumptives

To supplement the report of the special committee on Indigent Migratory Consumptives made at the last annual meeting, a study of this problem in Colorado Springs was undertaken by Miss Whitney, of the Association staff, in the spring of 1920. Later Miss Whitney's services were lent to the Colorado Tuberculosis Association for four months to make several surveys, one of which was a study of Denver, financed by the Denver Tuberculosis Society. At the committee's request, and in coöperation with the state associations in California, Arizona and Texas, Miss Whitney made a study of the problem in Los Angeles, Phoenix, El Paso and San Antonio. The results of these studies will be presented at this meeting.

4. Committee on Mortality from Tuberculosis in Dusty Trades

In addition to the two preliminary reports published by this committee in 1919, a final report is now in preparation. Since the resignation of Dr. Frederick L. Hoffman as chairman of the committee, a study of 500 granite cutters in Barre, Vermont, has been made under the direction of Dr. E. R. Baldwin, the chairman, and a report based on the physical and x-ray examinations of these men will be made at this meeting.

5. Committee on Study of Genetic Factors

The Committee for the Investigation of the Genetic Factors in the Morbidity and Mortality from Tuberculosis received a grant of $10,000 from the Missionary Fund of the Association in 1919, and secured the services of Dr. Raymond Pearl of Johns Hopkins University to conduct the investigation. Over 200 records had been completed when a fire at the University destroyed all the data. A new start was made and about 85

complete records were obtained when the fund appropriated for that purpose was exhausted. We understand that the Russell Sage Foundation has provided temporarily for the continuance of the work. It is not known when the results will be available to the National Tuberculosis Association.

6. Committee on Community Health and Tuberculosis Demonstration

The Framingham Committee has had its regular meetings during the past year. The work of the five years of the demonstration will shortly be ready for publication. The results achieved seem to be increasingly valuable in that they apparently show the definite reduction of the morbidity and mortality rates during the time of application of the intensive health measures.

The Appraisal Committee has been asked to make a visit and a survey some time during the fall. If this committee announces that the conditions laid down in its former report have been met, it is likely that the further handing over to the community of the health machinery developed by the demonstration will be effected. Dr. Armstrong has given part of his time to the important work of the National Health Council.

7. Committee on History of National Association

The history of the National Tuberculosis Association, which has been in preparation by a special committee of our board for two years, is approaching completion. Through the painstaking and untiring efforts of Dr. S. Adolphus Knopf, of the committee, data have been assembled from many sources. Although the printing of the history was postponed for a time on account of lack of funds, the board has now authorized the committee to proceed with the publication, including biographies of living members. Acknowledgment should be made of the assistance rendered by Mr. Jacobs, of the executive office staff, in preparing the history. It is hoped to issue the volume at an early date.

XIV CONCLUSION

In concluding this report, it is only just that suitable acknowledgment be made of the faithful service of all members of the staff of the executive office. Mr. Jacobs has taken up his work as director of publicity with his customary vigor, and promises to make it a greater success than ever. Mr. Hopkins has fitted easily and naturally into the responsibility for the administration of the executive office and has done everything possible to have the work go smoothly. Without mentioning other members of the staff, I wish to state that there is not one of them who does not deserve the sincere gratitude of the National Association as well as of myself for faithful and efficient service.

Respectfully submitted,

CHARLES J. HATFIELD,
Managing Director.

ADVISORY COUNCIL

Chairman

HAVEN EMERSON, M.D.

WASHINGTON, D. C.

HOW COMPENSATION IS PROVIDED FOR EX-SERVICE BENEFICIARIES BY THE BUREAU OF WAR RISK INSURANCE*

By Haven Emerson, M.D.

Washington, D. C.

The Advisory Council decided that there was nothing more vital and interesting than the subject of the care of the ex-service man or woman who has been afflicted with tuberculosis. It is interesting because it is the first time there has been a large group, a group of the same age, substantially selected through the same methods, who have been through certain experiences which may be considered by some as unusually helpful to their health and by others as most destructive to their resistance.

It is important because of the enormous magnitude of it as a governmental undertaking and the very considerable opportunity there is for extravagance, for waste, for error and because of the danger to the prestige of the medical profession and the social agencies of the government if they fail in their efforts to do as good a job as has been done by our allies.

It would be hard to see a better example or a more extensively carried out program than we have been watching north of us in Canada and our ambition should be at least to equal that. Whether or not we approach it will depend upon the determination that this Association and the physicians of this country have. The efforts of the government to do an intelligent, reconstructing medical job depends upon good clinical sense and experience.

The reason for the arrangement of our program is obvious to those who are familiar with the laws, the operation of the federal departments and the sequence of events which necessarily follow from the moment ex-service men or women believe themselves afflicted with a pulmonary disease until they are reconstructed as effective and self-supporting members of their community.

The duty which falls to my lot is to introduce the Association to those steps which are necessarily preliminary to the dispensing by the government of relief, medical attention or education.

The ex-service man believes or is told that he has some defect, physical or mental due to injuries or disease and he believes or is told that the origin of that has some relation to his army service. He thereupon makes an application or files a claim for compensation either through

* Since this paper was written the Bureau has been called the U. S. Veterans' Bureau.

some friendly agency in his own community, such as the Red Cross, or through the affiliation he may have with the Legion, or through a substation or one of the examiners of the Bureau of War Risk Insurance.

The application must show that the man was in service but the application does not need to show proof of the relation to service. That must be obtained by other means, by application to other sources of information. I shall not quote the questions that are in the official application blank.

It is sufficient to say that the experience up to the present time falls very little short of the expected load which has been looked forward to by the authorities in Washington since August, 1919, and upon which they have based their estimate of service hospitalization needs and probable expense.

There is some evidence, from the recent information we have received from the Ministry of Pensions in England, that we have over-estimated the probable duration of the rise to a peak of the load of cases; that we have probably been over-estimating the entire total, since in the English experience, they have already reached their maximum and the cases of tuberculosis have begun to go down.

We are approximately on the plateau of the curve of hospital census for general medical and surgical cases. We are still rising in our curve of hospital census of tuberculosis, and we shall rise for another year and a half in all probability. The neuro-psychiatric cases are increasing and this increase will go on for a long time, five years at least.

As we proceed further and further from the date of the armistice and further and further from the groups discharged or released from service, it becomes increasingly difficult to prove that pulmonary episodes, occurring for the first time, after a year and a half or more from service, were really of service origin. It is in this attempt to complete the medical evidence in the cases that the social agencies, the private resources of the hospitals, etc., are of direct assistance to the service man.

Up to the present time the federal government has not appreciated the necessity of having an organization or social service as a proper element in completing a medical diagnosis. If we attempted to arrive at medical diagnosis or to complete the cases coming to the dispensaries and hospitals, without the aid of all those accessory sources of information that we get from dispensaries and hospitals, we should fall very far short of getting the complete story of the patients.

The federal service has still to depend upon the Red Cross and other volunteer agencies to obtain what we may say is the threshhold of the medical history, or the beginning of the story of the patient, and further, we have to lean on just those same people in order to see that the man who is evacuated from a hospital is informed as to precautions he must exercise so that his post-graduate case of tuberculosis may not be lost because of his reckless manner of living as soon as he is discharged from the hospital.

As soon as the claim is made, a search is made through the Adjutant

General's records to find what really happened to the man in service, and any of you who served in the army recall the incompleteness of the official records and the somewhat scant courtesy shown them when hospitals were moved or evacuated, and the lack of completeness of the medical stories of the enlisted men in the service. The patient or the claimant may give bonafide stories that he had bronchitis on such a day, pleurisy on such and such days, followed by pneumonia, but it may be that there is no official record and the discharge shows that the man was discharged sound and in good condition.

One of the reasons why there is such great delay in the handling of claims and of satisfying these men is because we do not accept the failure of the Adjutant's office to provide records as final. When a man's case becomes lost, it may often take months to secure new evidence upon which to make a perfectly clear case; a case upon which the man can get the benefit of the compensation and medical care to which we believe he is entitled and for justification of which there is no evidence in the records.

Then there are always the social inquiries which bear upon the claimant and the amount of compensation he is entitled to. It is not always easy to unravel the social entanglements of the men who have been in the service. There may be first and second wives, various sets of children, due to the irresponsibility of individuals on both sides of the water, and this complicates a great deal the basis upon which we determine the amount of compensation.

All of these matters have to be studied intimately and these are much more complicated when the man has been traveling, trying to find work, shifting from city to city and has left no trace of his real permanent home surroundings. As soon as compensation is awarded, however, we find people will pop up who will try to claim a portion of it and to some extent cast a shadow of doubt upon the history received from the man.

Medical examinations are now being made by some four thousand physicians all over the United States. A great many of the examinations are made where hospital units have the proper facilities, laboratory and x-ray facilities for observation. The opportunities for hospital observation permit of a complete clinical report in the majority of the cases. I say complete, compared to some of the examinations that have been made in the past and will be made, I suppose, for a long time to come in the sort of helter-skelter manner that has been fairly characteristic of the average medical practitioner. We find not uncommonly that the man has been victimized by the inefficiency of the medical examination. It is our duty to raise the standard of medical diagnosis.

There are examinations or reports, chiefly of tuberculosis patients made in the various district offices which make one blush for one's profession. Many of the reports are such as we would not wish to have handed to anyone as a basis for admission to an institution.

The law requires that every benefit of doubt be given the claimant.

Men have been admitted to hospitals on suspicion of tuberculosis without having passed through skilled hands, without ever having had the presumption of a really accurate series of medical examinations which would prove the presence of tuberculosis, without adequate clinical history, and on what we would cite as a snap diagnosis.

The result was that a very accurate survey of hospitals was made in certain groups not long ago and it was found that from ten to twenty per cent. of those who had been hospitalized were there without adequate medical proof as to their diagnosis. It probably can be reported here as it was in France, where their hospitals were crowded with many thousands of men who had had not only the wrong diagnosis made of their cases, but were subjected to constantly increased risk, that the association with so many open cases under such varying and loose conditions of discipline and organization, made the danger of infection infinitely greater than would have been the case under home conditions.

Up to the present time, a scientific study of these records has not been practical, because of the insistent demands of the claimants for instant action. The demand for the actual study of the cases has prevented the recognition of the scientific value of this great mass of clinical material, for the first time collected at one central place. At sometime when we can get our files organized by disease groups instead of merely running in numerical order without regard to disease, there should be available for the students a vast storehouse of information as to the social aspects of tuberculosis and the valuation of clinical accuracy — enough for them to feed upon and work upon for a generation.

The medical ratings up to the present time have been made entirely at Washington, but within a few weeks this work will be distributed among the district offices, so there may be less inaccuracy. We shall have the examinations and the ratings done in approximately the same general administrative area, so that if there are any errors, there is a better chance of correcting them and greater opportunity for quick remedy. In the near future it will be possible to have trained examiners and trained instructors for disability work, in close coöperation with the same offices, and nearer to the homes and environments of the men, so they can have the information right at hand and meet promptly those difficulties which have caused delays and been the cause of a great deal of criticism against the federal government.

Here are some of the questions that must be asked. Was the disability incurred in service? That question may sound easy but the fact is that it is extremely difficult. Did the disability exist prior to enlistment? Was it noted at the time of enlistment? If so, was it aggravated by service?

I wish you would think of cases which you know of and try to answer to yourselves these questions that the Rating Officers in the Bureau must answer before they can conscientiously put through their statement that the applicant is entitled to free government service in hospitals and dispensaries and also a large amount of compensation in money over a long

period of years. It takes a great deal of care in order to give honest answers to those questions.

We took eighteen different types of cases that are constantly coming up, with and without pulmonary episodes, that apparently had been contracted in the army, and asked the leading tuberculosis specialists (some of whom are here in this room and others who are not; men who had seen service abroad and here in the army and who had seen service in hospitals after the war), to tell whether in their opinion these cases fell within the intention of the law. The government rating tables have been largely revised because of the character of the replies received from those physicians.

The experience of Belgium, of France, Canada and England has been sufficient to make it clear that not more than four per cent. of all the men known to have been gassed and hospitalized actually show now any pulmonary disease which can be attributed to the service. This refers to the men with records which show that they have been gassed. For every man that the records show as having beeen gassed and needing treatment at the time, I should guess there are about one thousand who say they were gassed and believe they were gassed, but this gassing, if it occurred, was probably not of a degree to be appreciated, either physically or pahtologically. Under these conditions, we feel that we must use the greatest discretion and not succumb to the lay conviction that the word "gassed" is automatically followed by tuberculosis. The sequence is not so clear from our observations as it is in the sentiments of the laity.

With this introduction as a beginning of the picture that we shall have this evening, we shall go on to the subject of vital interest to you all, and that is the actual treatment of the ex-service man. The first paper to be presented upon this subject and upon the program is by Dr. F. C. Smith, U. S. P. H. S., chief of the tuberculosis section of the Surgeon General's office, on whom falls the responsibility for arranging for beds in the hospitals for tuberculosis patients and the distribution of patients to those beds and the establishment of policies for care of tuberculosis patients.

PROVISION FOR HOSPITAL AND DISPENSARY CARE OF TUBERCULOUS EX-SERVICE PATIENTS BY THE PUBLIC HEALTH SERVICE

By F. C. Smith, Surgeon, U. S. P. H. S.

Washington, D. C.

There is probably not a man or woman in this audience who did not have some one near and dear in the military forces of the United States during the war. It may be safely assumed that each one of you is interested in the hospital problem both from personal as well as patriotic and professional motives. The U. S. Public Health Service is one of several agencies providing care for disabled ex-service men and women. The chart, figure 1, shows the actual and proportionate numbers of those so treated since March 3, 1919, for tuberculosis alone. The hospitals of the Army, Navy and National Homes for Volunteer Soldiers have been utilized so far as the facilities of each were available for the purpose. As will be seen, however, these agencies did not, until a few months ago, admit any considerable number of these patients, although other institutions, chiefly contract hospitals, played an important part. Approximately 10,000 tuberculous patients of the Bureau of War Risk Insurance are now in hospitals, about one-half of these being in Public Health Service institutions.

It is apparent that when the War Risk Act was passed October 6, 1917, Congress had in mind an extensive program of hospital care, for it must be assumed that there was contemplated the construction and equipment of a large number of suitable institutions to carry out the provisions of the Act. No funds were appropriated, however, for the construction or purchase of hospitals and no existing agencies were at that time designated to the task. The situation was somewhat similar to that when little Mary, six years old, invited a large number of friends to a banquet on Monday afternoon, but neglected all preliminary arrangements. When the expectant guests arrived there were no adequate provisions for a party and Mary's mother in a strenuous effort to make good has not been able entirely to avoid some disappointments and criticisms.

When the Act of March 3, 1919, was passed, making the Public Health Service an agency for providing hospital care, that organization found itself confronted by a serious emergency. Sick and disabled men in large numbers were demanding immediate discharge from the military and naval forces. When the armistice was signed, it did not make any difference to a man whether he had only one leg or only one lung, he

wanted to get home to his mother, wife or sweetheart. The army and navy were importuned to discharge the men, and who can criticize the policy of first sending these sick and wounded men to their homes? After a brief interval, however, the disabled men again sought hospital care and usually refused to enter army and navy hospitals, regarding with disfavor any institution associated in their minds with military experience.

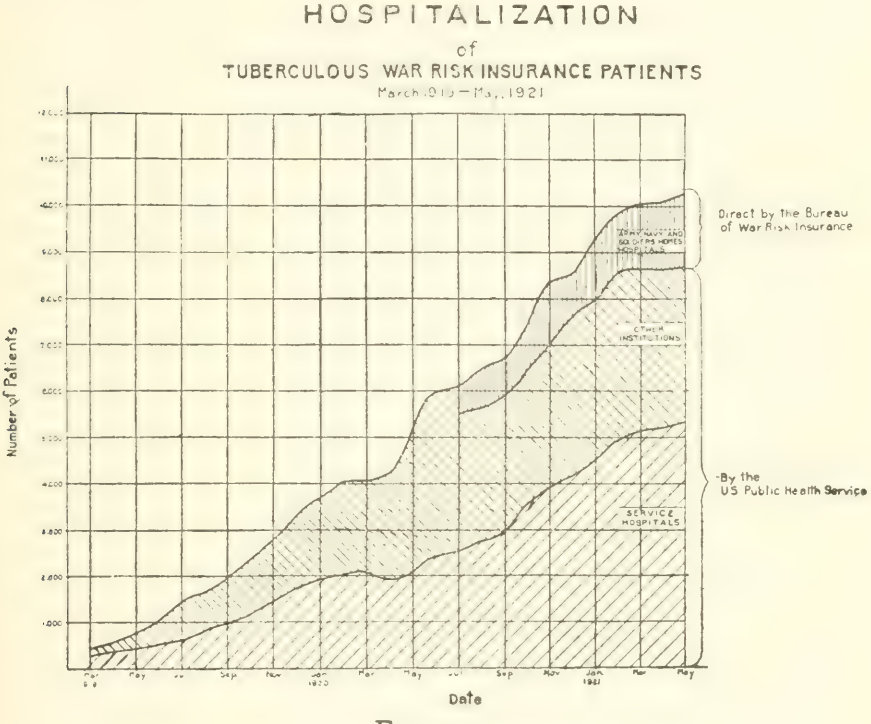


FIGURE 1.

This country is a military nation only when it is mad. At any time this country needs to be defended, men, some of whom are disgruntled now, will again put on their uniforms and fight just as they did before, but in time of peace they dislike anything that smacks of militarism. When men who had just been discharged from Camp Devens, Yaphank, Beauregard, Kearney or Sevier were offered care in army or navy hospitals they did not want to go, not because military nurses and doctors were not good to them but just because those hospitals and those places were associated with things distasteful to them. The army and navy were, moreover, reducing hospital personnel and at the time when needs were most urgent, were unable to receive ex-service patients into their depleted hospitals because of insufficient nurses and corpsmen. The Soldiers' Homes had not yet adapted themselves to the situation and

were not admitting any considerable number of those needing treatment. The situation was as critical as though due to some great disaster of plague or flood. The country's honor was at stake. Her promises must be fulfilled. Hospital care of some kind must be provided at once and of a character acceptable to the returned veterans.

Not unmindful of its traditions the Public Health Service endeavored to meet the emergency. There was for immediate use, approximately $10,500,000, the sum appropriated in the Act of March 3, 1919, to secure additional hospital facilities. This was of course insufficient to build or buy provisions for any considerable number of beds and indeed there was no time for permanent construction. Institutions were therefore leased or taken over from the army and navy. Some of its 22 old marine hospitals were enlarged by the construction of temporary wards. It increased the hospitals from 22 to 61 and its beds from 1500 to approximately 18,500, and opened 58 dispensaries in various parts of the United States. The personnel, which has been recruited almost entirely from men and women discharged from the army and navy, includes about 2700 medical officers of whom approximately 880 are employed in hospitals. There are 190 dental officers, 1500 nurses, 500 occupational therapy aides and 150 trained dietitians. It has, in the past two years treated approximately 150,000 patients and furnished a total of about 9,000,000 hospital relief days, made 1,000,000 medical examinations and has given about 1,200,000 dispensary treatments, not including dental treatment for 70,000 patients. Prosthetic appliances including artificial arms and legs have been furnished to thousands of patients. At the present time more than 4700 patients are being given occupational therapy and over 4500 physio-therapy each week. Vocational training is provided in all service hospitals by the Federal Board for Vocational Education.

When confronted with the emergency of providing hospital care early in 1919, the Public Health Service immediately canvassed the civilian hospitals throughout the United States and made contracts with approximately 2700 of these for the care of discharged veterans. Many upon inspection were subsequently found to be unsatisfactory and were discontinued. Contracts with more than 1500 civilian hospitals of various kinds were still in force when this part of the work was turned over to the Bureau of War Risk Insurance two months ago, together with the field forces which were engaged outside the hospitals and dispensaries in the examination of claimants. Those who have not spared criticism of the use of contract hospitals might be reminded that these institutions represented the standards of hospital care which prevailed in the various communities. They were near the patients' homes and offered the readiest means to treatment. If admission had been delayed pending the inspection of each contract hospital, imagine what outcries against government red tape would have been evoked from these same critics!

In perfect liaison with the Bureau of War Risk Insurance, a study was made of the hospital needs and a construction program outlined

early in 1920 which provided for 51 new hospitals at an aggregate cost of $85,000,000. Of these hospitals 11 were for general medical and surgical cases with an aggregate number of 2605 beds, 19 were for tuberculous patients with an aggregate number of 9330 beds, and 21 were for the neuro-psychiatric with an aggregate number of 9780 beds. The proposed locations were those calculated to serve best the various centers of population. As is, of course, well known, this program was not acceptable to Congress and no funds were appropriated during that year for the desired purpose. The emergency program was therefore continued and additional camp hospitals were taken over and the search continued for suitable institutions to lease for hospital purposes.

The hospitals of the Public Health Service are manned almost entirely by physicians, nurses, dietitians and aides who served during the war with the army or navy. The personnel therefore, is well prepared to regard with the utmost sympathy the disabled ex-service yeterans. The same is true of the field forces engaged in examining claimants in every city and large town. Wherever in the United States ex-service men applied for treatment they were immediately offered the best available, either in a local contract hospital or in the nearest government institution, and so far as the records of the bureau show, hospital care of some kind and fairly representative of the standards prevailing in that community was always offered. It has always been the custom to give the applicant the benefit of any doubt relating to his eligibility or to his need for hospital care and it has been the invariable practice to admit the patient to treatment without waiting for the outcome of his application for compensation and to discharge him from the hospital only upon the receipt of definite advice that his claim for compensation had been refused and that it is therefore illegal to continue him as a patient.

Many subjects needing hospital care have declined it, preferring to remain at home or to seek the boarding houses and hotels of popular resorts. It is not improbable that others have not applied for treatment, believing that they would be turned away. It must be said that buildings which were suitable for the treatment of men under military conditions lack the essentials commonly expected for the treatment of civilians who believe that they are entitled to more privacy and more of the luxuries attending hospital care than are possible in barracks or wards of military hospitals. There have been times when many beds were unfilled in the southwest but tuberculous patients objected to a transfer to such a great distance, desiring to remain near home. As each sanatorium was opened by the Public Health Service it was necessary to direct a stream of patients to each in turn, because the institutions became available, one at a time and several months apart instead of all at one time. For these reasons patients from the middle west were for a while sent to Greenville, S. C. A little later, the sanatorium at Greenville being filled, patients from the middle Atlantic as well as from all points west were sent to Fort Bayard, N. M., and later that institution as well as Prescott, Tucson, and Palo Alto being full, and Oteen, N. C., having been opened,

it was necessary to again divert patients from the west to the east and patients from points even west of the Mississippi, to that sanatorium.

There are at present 13 Public Health Service sanatoria for tuberculous ex-service veterans with beds aggregating approximately 6000. The sanatorium at Fort Bayard, N. M., of 1120 beds is the largest, then follow in order: Oteen, N. C., 1100 beds; Prescott, Ariz., 765 beds, soon to be enlarged to 1200; Greenville, S. C., 750 beds; Camp Kearney, Calif., 550 beds, and New Haven, Conn., a hospital specializing in surgical tuberculosis, 500 beds; the others are smaller. The institutions at Fort Bayard and Oteen have wards for female patients, to which tuberculous ex-service nurses are sent, approximately 48 being now under treatment at these places. According to the custom of the Service and as prescribed in the regulations governing procedure, tuberculous patients are admitted to any of its hospitals, special wards being designated. This in effect, makes a clearing station out of each large general hospital, the tuberculosis wards in each of the Service hospitals at New York, Baltimore, Chicago, Boston and other large cities sometimes containing from 50 to 200 patients.

A determined effort has been made to standardize the treatment of tuberculosis in Public Health Service hospitals according to accepted ideas. The Service has been fortunate in securing for this work the services of Dr. David R. Lyman of Wallingford, Conn.; Dr. Victor F. Cullen of Sabillisville, Md.; Dr. Martin F. Sloan, formerly of Eudowood Sanatorium; Dr. George Thomas Palmer of Springfield, Ill., and Dr. Henry W. Hoagland of La Jolla, Calif. These physicians, in two committees, visited the various sanatoria and made recommendations of a practical nature pertaining to all details of treatment. They were asked to criticize freely and to recommend such measures as were necessary to make the institutions first class in every way. Their services have been of inestimable value and it is planned to continue the policy as a permanent one provided the same or other competent specialists can be found to carry on the work. An officer who, under the auspices of the National Tuberculosis Association, initiated routine educational measures among sanatorium patients, has been continued by the government in that capacity, visiting the various sanatoria in turn for a period of approximately six weeks in each. By means of lectures, the organization of classes and by personal private interviews, he has been able to accomplish much in enlisting cooperation of patients in their treatment.

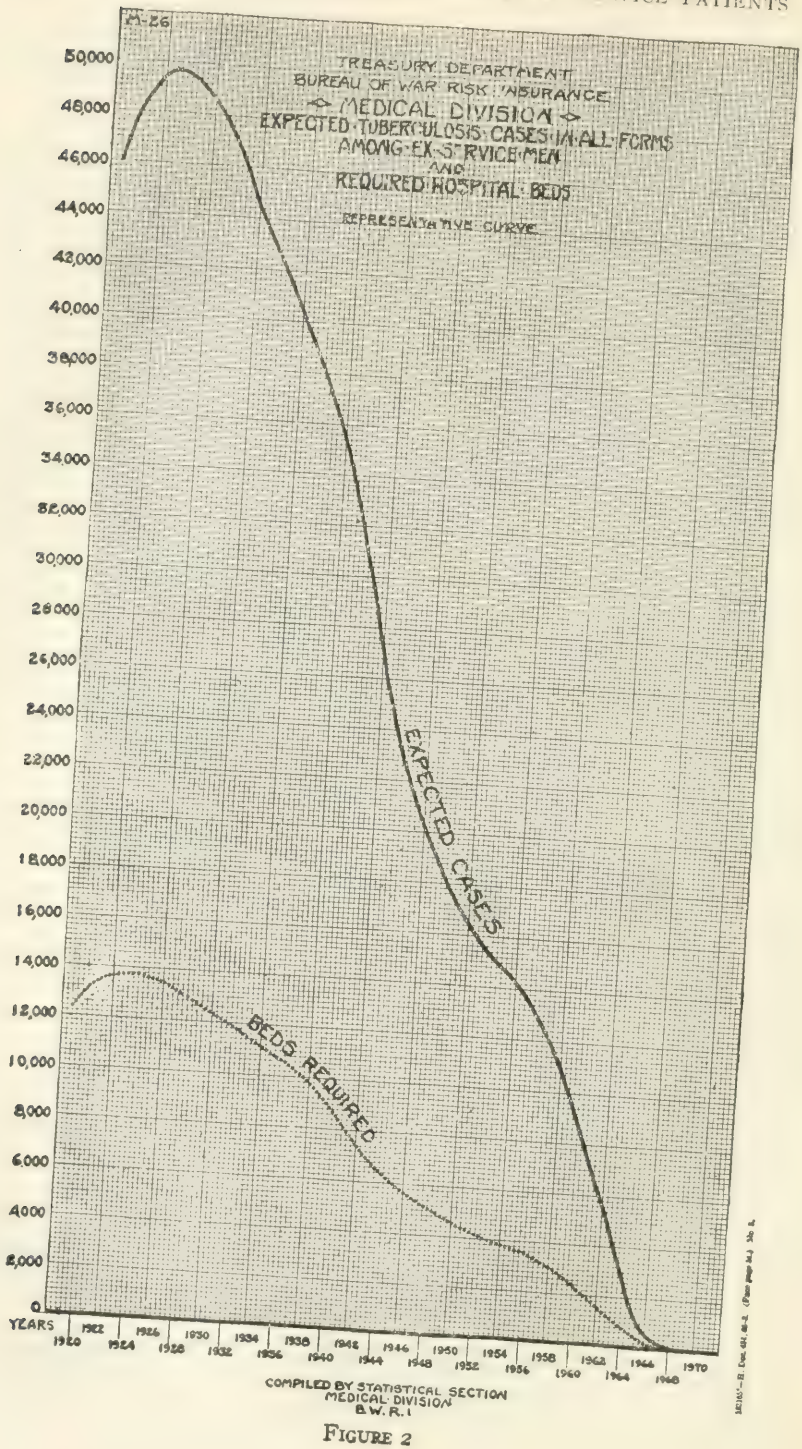
The general restlessness which still prevails among men formerly in military service increases the turnover in the hospitals and for that reason, treatment by pneumothorax, heliotherapy and other special methods have not until recently been as generally employed as was desired. It is a curious fact also, that graduated exercises or supervised exercises of any character are generally resented by the patients, apparently being associated with certain distasteful military duties, and it requires considerable tact and no little patience to secure a reasonable regard for the ordinary conventions and simple rules common in

sanatoria. It has required some courage on the part of officers on duty in these hospitals to refuse the demands for passes, furloughs or transfers, and not a little self-restraint to continue steadfast in the application of scientific principles of treatment.

A patient of the Bureau of War Risk Insurance who is admitted to a hospital becomes immediately eligible for an award of total temporary disability which carries a minimum allowance of $80 a month for a single man without dependents. If he remains in the hospital for six months or more, the Bureau of War Risk Insurance commonly awards him permanent and total disability which carries a minimum allowance of $100 a month and qualifies him to receive his insurance if insured. It thus happens that a premium is placed upon hospitalization and it is not unusual for men to apply for hospital care or for continuation in hospital for prolonged periods who under ordinary conditions of life would probably not make these demands.* In the tuberculosis hospitals a permanent board of medical officers, acting in accordance with a Bureau circular letter, endeavors to ascertain immediately upon admission of a patient, whether the subject is suffering from tuberculosis of a nature requiring treatment, and to discharge promptly those admitted under a mistaken diagnosis or through an error in judgment of the field officer making the original examination. The result of the deliberations of this board is in turn transmitted to the field officer responsible for an error, and this practice, while sometimes resulting in a brisk interchange of conflicting ideas between the parties concerned, has been productive of much good. It may therefore, be safely said that there are very few patients in tuberculosis hospitals of the Public Health Service not in need of treatment for tuberculosis. This may not be true of tuberculous patients in contract hospitals, the personnel of which is naturally less easily controlled.

The training of officers in the diagnosis and treatment of tuberculosis has been necessary, for although the government has been fortunate in securing a large number of men with special training in tuberculosis, it has not been possible to find a sufficient number. Classes were therefore organized at various points in the field and a standard course of training instituted wherever a class could be assembled and a teacher found. More than 400 physicians have taken the short course of instruction in accordance with a manual prepared and prescribed for the purpose. The nomenclature adopted by the National Tuberculosis Association is routinely employed and taught. Among those who served the government well in training medical officers were Doctors Gerald B. Webb, George T. Palmer, O. W. McMichael, Kennon Dunham, Adolphus Knopf, E. R. Van der Slice, Charles E. Castlen, Walter Marcley, George E. Ebright, Jarvis Barlow and C. L. Minor. In other

* Since the date of this address, Congress passed on August 9, 1921, "An act to establish a Veterans' Bureau and to improve the facilities and service of such bureau, and further to amend and modify the War Risk Insurance Act." Some of the practices referred to above have also been discontinued.


M-26
TREASURY DEPARTMENT
BUREAU OF WAR RISK INSURANCE
MEDICAL DIVISION
EXPECTED TUBERCULOSIS CASES IN ALL FORMS
AMONG EX-SERVICE MEN
AND
REQUIRED HOSPITAL BEDS
REPRESENTATIVE CURVE
50,000
48,000
46,000
44,000
42,000
40,000
38,000
36,000
34,000
32,000
30,000
28,000
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18,000
16,000
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
EXPECTED CASES
BEDS REQUIRED
YEARS
1920 1922 1924 1926 1928 1930 1932 1934 1936 1938 1940 1942 1944 1946 1948 1950 1952 1954 1956 1958 1960 1962 1964 1966 1970
COMPILED BY STATISTICAL SECTION
MEDICAL DIVISION
B.W.R.I

FIGURE 2

capacities no less important Col. G. E. Bushnell, Dr. E. R. Baldwin, Dr. W. C. White and Dr. H. A. Pattison of the National Tuberculosis Association have rendered assistance of the greatest possible importance.

The cinema film which Dr. H. F. Stoll of Hartford, Conn. prepared while a major in the army and which so well illustrates and teaches the examination of the chest, has been routinely used in connection with the training course, four sets of the eight reel cinema having been purchased by the Public Health Service for the purpose, through the courtesy of the Surgeon General of the Army. In all, more than 400 student officers have passed through the course, not including officers who are required to receive the instruction immediately upon being assigned to duty at a hospital. A training course of four weeks for medical officers and nurses is proposed at the Public Health Service sanatorium at Oteen, N. C., at intervals, the first class to report there on September 6, 1921.*

There is an impression among the laity that tuberculosis has been greatly increased in the United States as the result of the war. The curve, Figure 2, shows the incidence of tuberculosis which it was estimated would occur among discharged veterans, the maximum number of nearly 50,000 cases appearing in 1923 and demanding about 14,000 hospital beds. It represents approximately the normal incidence of tuberculosis among males of military age. An equal number of cases presumably occurred in the same age group in pre-war periods. There is no reason to believe that tuberculosis has been greatly increased in this country as a result of the war. We have, however, been furnished with convincing evidence of the fact that tuberculous patients usually submerged and shunning sanatorium care, are ready to avail themselves of proper facilities to promote recovery whenever the opportunity and practical means are provided.

In anticipation of the time when ample funds shall have become available for construction purposes, plans have been prepared for tuberculosis sanatoria of standard types adapted for use in various parts of the United States and for the various classes of tuberculous patients. Through the cooperation of the National Tuberculosis Association, Mr. T. B. Kidner, Institutional Secretary, was engaged to make the necessary studies and to prepare minimum requirements in construction. The results of this study and the cuts showing type plans were published in Public Health Service Reports, Volume 36, No. 24, June 17, 1921.

The Chairman: I think all of us have wished that we might have in private institutions and hospitals, an organization or group capable of starting educational efforts while the patients are still under medical

* This training course, which was completed on September 30, 1921, was attended by more than 40 physicians and nurses and was very much of a success. Miss Alice Stewart, Superintendent of the Pittsburgh Tuberculosis League, and Miss Mary E. Marshall, Secretary for Nursing, National Tuberculosis Association, assisted materially in conducting this course.

care and capable of carrying this education through until the patient could be discharged therefrom with some regular, recognized occupation.

Mr. Uel W. Lamkin, Director of the Federal Board for Vocational Education, has made it possible, through enforcing the rights he had under the law, to accomplish a decentralization policy. This is but the beginning of what can be accomplished, through the recent action of the Secretary of the Treasury in regard to the activities of the Public Health Service and the Bureau of War Risk Insurance.

I consider it a great pleasure to introduce to you on this occasion, one who has done very much toward the care of our disabled soldiers, Mr. Lamkin.

Hon. Uel W. Lamkin, Washington, D. C.: I share with Dr. Smith the feeling that after the true story is told of America's treatment of the ex-service men, the citizens will be proud of the record. Dr. Emerson spoke about the work being done in Canada. I don't think there has been time to measure accurately the effectiveness of such a great piece of work as the rehabilitation of the disabled service men, but I would call to your attention the fact that on the thirtieth day of April, 1921 Canada had actually placed in training 39,000 men while on the fifteenth day of May, the United States had in training 75,761 men. There were practically the same number of disabilities in the two armies. Some two years ago it was a question whether we in this country should have to train thirteen thousand or fifteen thousand men.

So far as I know, there are no men, or practically very few men, who are waiting for training, after they have been declared eligible for it, for the reason that the government is not ready. It is true that there are some thirty thousand men out of training who have been declared eligible for training but of those, five thousand have definitely declined and from five to ten thousand have asked that their training be deferred.

You can not speak of this work in terms of money. A little over two years ago Congress appropriated two million dollars for this work of rehabilitation. Chairman Good of the House Committee told a friend of mine that Congress proposed to see this through if it took twenty million to put it over. In the month of April, you spent through the Federal Board for Vocational Education for rehabilitation, a little over eleven million dollars. That is for one month alone. Eight million of that went direct to the soldiers themselves for their own maintenance. More than two million dollars additional was spent on the soldiers for tuition, books, supplies, medical care, and things of that kind.

Approximately eight per cent. of the total was spent for over-head which includes the maintenance of fourteen district and 140 local offices, traveling expenses, salaries of employes, etc. Of course that is not the story which is carried in the newspapers. I had the privilege of saying a day or two ago that the rehabilitation of these disabled men will not be carried out through the Congressional Record or the

newspapers of the United States, but it can only be done by hard conscientious work by men and women who are engaged by the Government to do the work and by people like you who belong to an association which is devoted to the eradication of a great plague and to the bringing back of the men to normal civilian life. It is being done in spite of great handicaps. I will not discuss them with you but will merely cite one of them.

We are criticized for spending money, but I expect to spend the money that Congress appropriates for the rehabilitation of the disabled men. I told a Congressional committee a day or so ago that in the next thirty days the War Department would probably declare a surplus of over a million and a half dollars worth of Federal property and that the Vocational Board needed it for the training of disabled men. We can't get one dollar's worth of what the War Department is going to put on the market. They will put it on the market as surplus and someone will buy it from five to twenty-five cents on the dollar but we, a government agency, can't buy it. This property will be bought by private individuals and if we want any of it, we shall have to go on the market and pay that private individual one hundred cents on the dollar.

A few days ago a gentleman came to us in regard to leasing us a building at Nitro, West Virginia and I asked him how he happened to have it. He said it was sold to his company by the War Department. I asked him at what price and he told me at five cents on the dollar. I said to him, "We can't lease it from the War Department, we can't buy it from the War Department, they can't lend it to us, but they can sell it to you under the law and you can lease it to us." Those are some of the difficulties we have.

My purpose here tonight is to render an account of our stewardship, in a way, to this Association, which has been of such inestimable value to us. Approximately two years ago you appointed an Advisory Committee. It was my pleasure to sit at dinner with the Advisory Committee tonight. I hope that this Association will continue either that committee or another committee to help us and to guide us in the rehabilitation of our men suffering from tuberculosis.

What I shall say tonight will be more in the nature of a report to this Association of what has been accomplished along the lines laid out by that Advisory Committee.

VOCATIONAL TRAINING FOR ARRESTED TUBERCULOUS PATIENTS BY THE FEDERAL BOARD FOR VOCATIONAL EDUCATION

By Hon. Uel W. Lamkin

Washington, D. C.

The Federal Board for Vocational Education takes no small amount of pride in reporting to the National Tuberculosis Association concerning our united activities during the past year in working toward the solution of the problem of tuberculous ex-service men.

It was through the courtesy of this Association that an Advisory Committee of eleven leaders in tuberculosis work was brought together as a National Advisory Committee, and that they lent their Field Secretary, Dr. H. A. Pattison, to the Board as an expert advisor to assist in formulating policies and methods for dealing with tuberculous ex-service men.

Two of the most outstanding features of the Board's work during the current fiscal year have been, first, its decentralization policy, bringing the service which the Board has to offer nearer the homes of the men through 140 local offices, and second the increase in the numbers and variety of training centers established, — a development which began with training centers for the tuberculous, but which has broadened into a much wider field. In February, 1920, we had three centers, a staff of five and an enrollment of 95 trainees. In February, 1921, we hed 154 centers, a staff of 614 and an enrollment of 7867. In April, 1921, the latest figures which have been compiled, we had 153 centers, a staff of 823 and an enrollment of 10,577. A third reason why the Board takes pride in this development is our feeling that, carrying on a work begun in the Army, we are pointing the way to a new field of social effort, particularly to those who may suffer from industrial accident or disease.

Public consciousness of the value of human salvage, resulted in the legislation known as the Industrial Rehabilitation Act. To the eyes of workers in the Rehabilitation Division, a new profession is looming up, pre-requisites for which will be a knowledge of disease and injury, particularly such as are incurred in industry, and skill in adapting to disabled individuals such sound methods of training as will result in the restoration of the individual to society in a productive capacity under favorable health conditions. As evidence of this, let me cite the fact that Harvard University is offering this year, in coöperation with the Federal

Board, an educational and training course for those who are interested in, and propose to work in, the field of industrial rehabilitation. Furthermore, there are many reasons for believing that occupational therapy will, before long, be a feature in treatment in all modern sanatoria, dealing with tuberculous and neuro-psychiatric cases. One state has recently requested the services of one of our workers in the latter field to lay out a policy and program for its institutions. Of particular interest to the Association is the special phase of this future service which will require a knowledge of tuberculosis, of modern methods in its treatment, of tuberculosis hygiene; and which will necessitate much skill in adapting to quiescent and arrested cases such training as will restore the individual to employment at a maximum of remuneration and healthful conditions, and a minimum of physical effort and nervous strain.

In describing to you what has been accomplished, we do not look upon this work as a finished performance. It is too new, and there are too many factors involved. However, we are finding almost unanimous testimony from heads of hospitals and sanatoria, from specialists in dealing with the tuberculous, from field agents of the National Tuberculosis Association, that the work is bringing to disabled men certain very positive assets.

As a result of conferences and communications between the Federal Board and the U. S. Public Health Service, the Bureau of War Risk Insurance and this Association, a definite coöperative policy has been established whereby six types of training centers are being developed by the Federal Board. These are:

(a) Public Health Service Hospitals where the nature of the cases under treatment make training feasible and the numbers are sufficient to justify training personnel.

(b) Private sanatoria where there are over 30 ex-service men as patients.

(c) Tuberculosis communities where there are sufficient number of ex-service men in boarding houses, hospitals or sanatoria.

(d) National Soldiers' Homes where quiescent and arrested tuberculuos cases are to be found who are eligible for training under the Rehabilitation Act.

(e) Community centers in localities where ex-service men may be found who are not availing themselves of an award of training under the Rehabilitation Act, irrespective of the nature of the disability or whether the trainee is eligible for section 2 or section 3 training.

(f) Federal Board Schools especially planned for inactive tuberculous cases, or neuro-psychiatric cases.

Primarily, the work in a training center in a hospital has three purposes.

(1) To furnish educational and pre-vocational training and so to stimulate the patient that upon his discharge he is ready and anxious to continue vocational rehabilitation.

(2) To assure that time spent in a hospital shall have a vocational as well as a curative value, thus saving to the patient much time and energy otherwise lost.

(3) To afford opportunity to compile all information and to do all paper work on the patient's case before he leaves the hospital, thereby assuring quick action and decision regarding his training after discharge from the hospital.

Before the work in hospitals and sanatoria could be inaugurated through governmental agencies, certain broad principles of general policy and method had to be determined and agreed upon by the agencies charged with the responsibility of the care of the disabled ex-service men. The Advisory Committee of the National Tuberculosis Association, through Dr. Pattison, in a report filed with the Board, June 10, 1919, made certain specific recommendations.

1. That every man who has once manifested active tuberculosis must be considered to have sustained more or less permanent disability, and urged that the Bureau of War Risk Insurance and the Federal Board judge him to be entitled to compensation, the minimum rate of which should be not less than 25 per cent. With the award and rating in terms of percentages, the Federal Board has nothing to do officially, but it has probably gone as far as the committee recommended and perhaps further, because the Board has ruled that a man who has manifested symptoms of active tuberculosis incurred, increased, or aggravated in the service, shall be entitled to an award of training with training pay, during such period as is necessary in order to enable him to secure employment in a line which is appropriate to his mental ability and compatible with his physical disability.

2. The committee suggested that while an award of compensation should be judged to be "more or less permanent" it might be subject to revision on the basis of subsequent physical examinations. Legally, the Board is not concerned with the recommendation because it undertakes to train the man as long as he needs training, and if his disability yields to treatment and training, the Board does not judge its responsibility discharged until it has placed the man in suitable, gainful employment.

3. The committee recommended that compensation should not be withdrawn because of individual success in overcoming the handicap unaided. Compensation is not so withdrawn, and in fact every effort is being made not only to provide compensation but to extend hospital and sanatorium facilities throughout the country in a way and to a degree that will make appropriate treatment and training under the best of conditions available to every ex-service man suffering from the results of tuberculosis or other disease of the respiratory system.

I cannot speak from a medical standpoint. I do not know that any one can tell accurately whether or not the percentage of tuberculosis in ex-service men is greater, because of their experience in war, than it would have been had they remained in civilian life, but the government's obligation under the circumstances is clear, and has been recognized, and with

all the available force at the command of the Bureau of War Risk Insurance, the Federal Board and the Public Health Service, every effort is being made to discharge the obligation at the earliest possible moment.

4. It was recommended that the Federal Board exert every effort to secure a clear cut definition of policy and program by the Bureau so that its own policies and program may be stabilized and delays reduced to a minimum. The recommendation has been carried out.

The Board's policy is "clear cut" in regard to the tuberculosis ex-service men. It searches him out in his home and offers him training. It goes to the hospitals and sanatoria and begins his training there. If he desires, immediately on being declared an inactive case, he may, in certain parts of the country, and just as rapidly as we can develop them, in all parts of the country, step from the hospital to a special Federal Board school. He is continued in training, if he manifests a disposition to profit by it and his physical condition permits.

5. The committee recommended that the Federal Board make every effort to induce the Bureau of War Risk Insurance to concentrate such disabled men in selected sanatoria. Pursuant to authority granted by Congress in coöperation with the Board of Managers of National Soldiers' Homes, the Bureau has developed a national sanatorium for tuberculous ex-service men at Johnson City, and a large number of its beneficiaries are cared for in the National Soldiers' Home at Dayton, Ohio, in the National Soldiers' Home in California, and in the Soldiers' Home at Hot Springs, South Dakota. In addition, at Marion Soldiers' Home, it has developed a national sanatorium for the neuro-psychiatric. In each of these places, the Board is operating a training center.

The remainder of the recommendations made by the committee related more specifically to the particular problems of the Federal Board under the Rehabilitation Act. Every one has been followed in spirit, if not in letter. I shall not attempt to discuss these in order but cover the recommedations by a general statement of what has been accomplished up to date.

The Board began its first hospital work in coöperation with the Public Health Service by a survey of the facilities at Greenville, South Carolina, in January, 1920. Lest you think there was unnecessary delay in this movement, let me point out to you that, during the period between the filing of the report and the beginning of the hospital work, the Rehabilitation Act was substantially amended, increasing the load of potential trainees; and that, by amendments to the Appropriation Act of the same year, the Federal Board's trained staff was diminished by one-third, because of resignations, largely due to reductions in salaries. Also, important modifications were made in the laws relating to the services of the Bureau and the Public Health Service, and a considerable change of personnel in those organizations was occasioned thereby. The work at Greenville has been typical of what has taken place in 46 Public Health Service hospitals since. The Public Health Service has reserved to itself therapeutic training. For example, as bedside and porch occupations, the

Public Health Service provides such work as weaving, wood-carving, jewelry, pottery, academic and commercial studies, gardening, printing, radio telegraphy, etc. It has agreed that the board shall provide, for ambulant patients, training of a pre-vocational character, such as drafting, poultry-raising, cabinet-making, automobile driving and road repairs, vulcanizing — 26 in all. At this hospital we now have an enrollment of 495 trainees, and a staff of 16 employees. We have authorized expenditures of $16,500 for maintenance and operation.

The committee recommended that in tuberculosis communities, such as Saranac Lake, the board should establish a convenient place where men might come from sanatoria, if able, and be taught a variety of lines of work, and in addition, that the Board should provide craft work by means of aides who could go to the sanatoria. We established such a center at Saranac Lake in April, 1920, and the work there given is typical of what is being done at El Paso, Texas; Liberty, New York, and other points in the country.

In all hospitals and sanatoria outside the jurisdiction of the Public Health Service, the board provides any kind of training appropriate to the needs of the men, including handicrafts, occupational therapy, elementary education, etc. It should be borne in mind that all exercise in any hospital, as to its length and severity, is subject to an "occupational" prescription by the physician in charge, that is to say, the physician in charge states to our educational director what the man may take without injury to his condition and for how many hours a day he may take it.

From these small beginnings has grown another development. The old theory of treatment and training, was that a man, on being declared inactive in a hospital, would, on discharge, return to his home, there live on his compensation, and in the course of three to six months, become an "arrested" case. From the very conditions of the situation, this theory could never work. Tuberculous men need to learn the hygiene of their disease. They must learn how to live as tuberculous men should live. They must have proper nutrition and exercise, must know what to avoid and what to do. Society has made no adequate provision for any such after-care for all tuberculous people in the community. As a result, cases were reactivated, not a few have broken down in training, and the net results were unsatisfactory. To meet this situation the Board has leased property and developed schools, to the end that during the "hardening up period," men may receive proper care and at the same time begin their training. We begin by teaching occupations which are compatible with the disability. At each center a medical expert in tuberculosis is stationed who is charged with the responsibility of all matters relating to the physical condition of the trainees. He has the authority to approve the diet, and to prescribe length and severity of exercise during the entire time the man is at such a school. Thus far we have developed schools at Pocono Pines, Pennsylvania; Waynesville, North Carolina; Pascaguola, Mississippi; San Antonio, Texas; Nauvoo, Illinois. Arrangements are now being made for opening others, and the policy of extending these

schools throughout the country will be followed, so far as necessity requires.

One of the ideas stressed by the advisory committee in its report and in a publication put out by the Board was the colony for the tuberculous. Those of you who have read the committee's bulletin entitled "The Agricultural and Industrial Community for Arrested Cases of Tuberculosis and their Families" have noted, without doubt, its recommendations in regard to the somewhat cautious methods of selecting families, the need for industrial endowment and other matters which imply a rather slow and conservative growth. It must be borne in mind, however, that the needs of the ex-service men have not permitted slow and conservative growth.

The Pascagoula Training Center was opened February 25, 1921. Since that time it has grown to a center in which 338 men are being trained, with 17 staff members. We secured property from the International Shipbuilding Company in which to develop class rooms and shops. There was a large number of vacant cottages, which had been built for ship yard workers. Forty per cent. of the trainees are married, and are living with their families in these cottages. All of a sudden, we have developed a community of upwards of 500 people, most of whom have not lived in towns. They have brought all the difficulties which an equal number of people, moving into a town under similar conditions, could possibly bring, and the solution of all the problems involved is a tremendous but vitally interesting task. Time does not permit a description of all the activities going on, but it will be clear to you that a rehabilitation program in such a community includes not only a wide variety of vocational training but it includes medical care, a recreational program, nursing service, tactful and wise social service, and instruction in a variety of ways for wives, as well as for Federal Board trainees.

The advisory committee recommended the publication of certain bulletins and circulars for the guidance of Federal Board staff and others dealing with the problems of tuberculous ex-service men. This has been done, and thousands of copies have been circulated; and, from reports received, we believe have accomplished in a measure the purposes for which they were intended. One such publication is our Bulletin No. 59: "A Tuberculosis Background for Advisers and Teachers." Twelve thousand copies of this document have been circulated not only to our own staff, but to superintendents of hospitals and sanatoria throughout the country. It would seem that this document is regarded as one of the most important publications in the whole field of tuberculosis literature and fills a decided need.

Prior to the war, neither the theory nor the practice of employing occupation as a phase of treatment for the tuberculous, had been generally accepted throughout the country. In this report of the advisory committee, Dr. Pattison cited two conspicuous experiments, one at Rutland, Massachusetts, under the guidance of Dr. Bayard T. Crane, and the other, the Hochhauser Shops in New York City. It was recommended

that the Board assist in developing the Rutland experiment, and that shop experiments in conjunction with the National Tuberculosis Association should be extended. Both of these ideas have been accepted. The Rutland Sanatorium Association, in coöperation with the Federal Board, has developed the New England Vocational School, where ex-service men from nine sanatoria in the vicinity are transported to the school. Instruction is given in the following lines: Poultry-raising, gardening, jewelry repair and watchmaking work, variety of commercial pursuits and a variety of woodworking occupations. Other lines will be added as needs arise. In addition to the work done at the school, Federal Board teachers go out from the center to the sanatoria and instruct in handicrafts, or give tutorial instruction as needed by the individual man.

The only shop experiment thus far developed has been in coöperation with the New York Tuberculosis Association through the Reco Shop. In May, 1920, the board agreed that the Association, at the expense of the board, through a tuition rate, should develop occupational and therapeutic training in four sanatoria readily accessible and dealing mostly with the city men. It was felt that agents of the Association should have this opportunity to establish an acquaintance with the men while they were still undergoing treatment, and at the same time to develop a program which would reveal aptitudes and skills. Starting with this acquaintance with, and knowledge of, men who will, under any conditions, live in the city, it seemed likely that a program of training could be developed in shops along lines which would be compatible with disability, and would yield to the men sufficient wage to support them when they were ready for placement in industry.

The Work-Shop for Industrial Rehabilitation of the New York Tuberculosis Association was opened in June, 1920. Up to March, 1921, 120 ex-service men have been admitted and 75 were in training March 1. The Work-Shop is situated in the newly developed manufacturing section of New York City, and is a new, up-to-date and sanitary building.

"The amount of work, as well as any increase of it, that each man is first allowed to do, is specifically prescribed by the Medical Officer * * * A trained social worker investigates and visits regularly the home of each man. The advice of the physician is emphasized and followed up * * * The trades taught * * * are watch-repairing, jewelry manufacturing, and cabinet-making, chosen because they are neither injurious to the lungs nor especially fatiguing * * * The present wages men may earn in these trades are from $40 to $75 a week.

It is the intention to make the city model work-shop the last step in the training and treatment of the tuberculous, * * * to increase gradually the working hours of the men with arrested tuberculosis until he can do a full day's work; to teach him a well-paid trade, keeping him all the while under medical observation until his ability and physical condition warrant discharge; finally to find him a suitable position. Thus trained, hardened and reëstablished in life, his chances of again falling a victim of tuberculosis will be minimized, and he can take his place in the community as a healthy, self-respecting, self-supporting citizen."

The advisory committee recommended that a special unit for the selection of appropriate training courses, for advising in suitable occupations, and for the following up of tuberculous men, be developed in each district office. This has been done. In each district office there is a medical man who is a specialist in tuberculosis, and we have trained laymen who, acting with the medical officer, can and do give appropriate advice regarding occupations and training therefor.

Properly qualified medical men have been difficult to obtain for governmental service. They have been in demand for many other lines of work. We have never had the staff we would like to have, but in so far as possible, we have maintained one or more men at central office for the general guidance of our program of training and for expert and advisory service in the field.

The final recommendation in the report was that, "There should be an after-care secretary in the central office, whose business it would be to put into the hands of the district vocational officers all the follow-up information that can be obtained; to prepare the proper forms for follow-up reports; in all ways possible counsel with the administrative officers on the follow-up service. This officer should coöperate with existing social agencies in obtaining his after-care data, thus making it unnecessary for the Federal Board to build up a social service organization of its own which would be largely a duplication of the work of other agencies." The intent of this recommendation is being followed, although from an administrative standpoint, not exactly as written.

The Board has on its payroll at the present time 172 nurses. Nearly all of these nurses were in active service. They know the condition of these men through their work in the army hospitals, through home contacts with the men and their families, and through other phases of the follow-up work. There are probably no "arrested" cases in regular training in institutions or on the job who are not followed up by personal visit at least once a month. On trips of inspection, it has been gratifying to find the excellent coöperation and encouragement given the nurses. "The reports from the district and local offices show it would have been impossible to have carried on the work successfully without the follow-up supervision, especially with the tuberculosis trainees, who had, in most cases, been given no instructions in hygiene. The total number of visits made during the month of April, 1921, was 42,560 and the number found needing emergency medical care, 7,902."

The suggestion of the advisory committee that existing social agencies should be used for follow-up work was probably pertinent under the conditions when it was written, but the Rehabilitation law has been liberalized in a variety of ways since that time, and it is not possible to turn over to volunteer agencies the great volume of follow-up work in matters relating to social and family relations. At the present time, the board has on its staff in the field, in addition to the nurses previously mentioned, 22 ex-Red Cross workers; five others are on the payroll of the Red Cross. It is antcipated that this number must be substantially increased.

In February, 1920, our work began with three training centers. In Public Health Service hospitals, we are now operating 44 training centers; in National Soldiers' Homes we are operating 6; in state, county and city hospitals, 31; in private sanatoria, 46; and in Federal Board schools, 56. Eighteen centers are too recently established to report; total is 201. So far as possible, we have employed in this work people who have had experience in the reconstruction service of the army.

This development in the Board's service has come about within the last eighteen months. It is still growing. We have made use of the best knowledge we could get, but in many phases of the work in these centers, we are making precedents, not following them. We want your continued support. We welcome your constructive criticism.

The Association would probably be interested in the training and employment records of a few rehabilitated men who had been trained because of the handicap of tuberculosis.

A Russian who had been partially educated as a physician, in Vienna and Switerland, was in training with the Federal Board for four months and two days, at the end of which, he found suitable employment as an X-ray technician. In a letter he states, that, as far as his course of study is concerned, and the benefit accrued therefrom, he is "more happy than he can tell."

An Italian had been employed as a tailor, before entering the service. He was given a course in pattern-making and clothing design, for a period of eleven months and two days. He is now employed in a designing school in Boston, Massachusetts, at a wage of $30 a week.

Another man, who had been a cashier and stenographer in a small position, paying $75 to $100 a month, prior to entering the service, was given additional training for four months and twenty-seven days at Tucson, Arizona, after which he was suitably placed as a bookkeeper in Minneapolis, Minnesota.

A young man who had never had regular employment, having been employed as a cashier while still a student, his highest wages during that time being $31.50 per week, was placed in training for work as a surveyor and assayer. At the end of a year in training, he obtained a position with a mining company in Arizona as an assayer, wages $175 a month.

A man, whose occupation had been general auto-mechanics, was given training at the Dayton Engineering Laboratories in specialized work on ignition systems. His training in this speciality involved much lighter work than his previous occupation demanded. It enabled him to secure a position in Cincinnati at $35 a week to begin.

The last case I shall cite is that of a Norwegian, who had worked at general farming, mostly on his father's farm. He was offered a training course in specialized agriculture at the University of Minnesota, but did not complete his course. At the end of four months, he stated that he was able to take up his work with his father and carry on agricultural projects which had been planned prior to his entrance into the service.

He discontinued voluntarily, and expressed himself as suitably employed and satisfied with both his treatment and his training.

If time permitted, it would be a fascinating study to go into the cases of these men by the hundreds. But the mass of evidence goes to prove the old conviction, that a person who had developed tuberculosis was down and out, entirely erroneous, and leads to the conclusion that wise treatment and training in occupations adapted to the disability, coupled with the coöperation of the trainee, are sufficient to return him to civilian life, completely rehabilitated, "physically, spiritually, and economically."

After all is said and done, it is more important to know what disabled men think of our work than to know what you and I think about it. I am quoting from a letter recently received from a disabled ex-service man at Fort Bayard, New Mexico. His statement would readily be endorsed by thousands of men in similar circumstances:

> The writer used the phrase "this isolated section of the United States" or words to that effect — however, we realize we are not as isolated or as far away from Congress and our friends as the railroad time-tables would lead us to believe — we fully appreciate we are mighty near to our frineds, not only in Washington but throughout the United States, and the disabled ex-service men and women of today do or should appreciate that our interests are quite well guarded and the laws which have been passed in our behalf have been most generous. Take for illustration, the Act which secures for us the benefits of the Federal Board. That Act certainly will go down in history as one of the most phenomenal pieces of legislation ever enacted by our American Congress and when we ex-service men and women fully appreciate the full significance and scope of this Act, then and only then will we be in a position to comprehend the meaning of this Act — REHABILITATION — What a wonderful field it covers! I believe I am safe in stating that the Federal Board for Vocational Education has yet to meet the first disabled ex-service man or woman whose case is too complicated to be solved. That one statement is based on actual experience and facts. No matter where we go we come in contact with disabled ex-service men and women who are receiving or who have received guidance in one form or another through the Federal Board for Vocational Education.
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> We can be discharged from the Army, Navy or Marines. It matters not what our physical condition may be — if, after a thorough physical examination, the doctors determine that training is feasible, the Federal Board can take this disabled man or woman, whether they be blind, deaf, dumb, or practically mutilated as far as our body is concerned, the Federal Board can train them to once more become rehabilitated and follow some gainful occupation. Our physical condition may be of such a nature that hospitalization is necessary for a short period — in other cases for a prolonged period, nevertheless the hospital training centers which are now being organized, and which have been functioning so efficiently in the various hospitals under the supervision of the Federal Board for Vocational Education — they will take us up even though we are undergoing medical attention, and will help us take advantage of time which would otherwise be lost while we were in the hospital. This is a phase of the Federal Board work which deserves most favorable criticism and comment. Take for illustration, this hospital — there are approximately a thousand disabled ex-service men and women, the vast majority being tuberculosis patients — some cases in a mild stage of activity, some in an aggravated stage of activity, while

other cases are arrested and in the convalescent stage. At present, one and all have an opportunity to devote a part of each twenty-four hours to either occupational therapy or vocational training. Harmonious, cooperative arrangements are in effect whereby the Chief Aide in charge of Occupation Therapy in the Reconstruction Division of the Public Health Service and the Training Officer in charge of Vocational Training have a cooperative agreement which eliminates duplication of work and brings about quite satisfactory division which affords the patients an opportunity to take advantage of the services offered by one or the other department.

When we all work together, governmental agencies, semi-public agencies, and finally, the trainees themselves, in the spirit of this statement, the task of rehabilitation will be accomplished.

The Chairman: I want to introduce to you now, one of those household words. I want to ask that you give your attention to one of our own representatives. There always has been and there always will be in governmental agencies, a tendency to lean heavily upon experts in civilian life who are free to form their own opinions and express their own opinions without the hindrance or the limitations of officialdom.

The advantages of expert advice from the professional field, from the clinical and practical nursing field was first appreciated by the French after Dr. Biggs' famous survey of the conditions in France. Soon after he was there, there was a group of men who went throughout the hospitals and relieved them of the fear of the enormous tuberculosis burden, by eliminating those who were not tuberculous.

The Federal Board for Vocational Training, the Bureau of War Risk Insurance and the Public Health Service have all leaned somewhat upon the officers, upon the directorate and others in the National Tuberculosis Association to obtain guidance, and it is this part of the work on which Dr. Lyman will now make a report.

Dr. David R. Lyman: Just a brief word in explanation of this paper beforehand. In my work in connection with your Association and through the courtesy and close coöperation with the heads of the three services, I had a chance as an outsider, and in conference with several others who had had similar chances, to get a very close glance into some of the government's problems. I have seen in these services, the men at the head of them, fired by big ideals, working on one of the biggest jobs that was ever undertaken and under almost insurmountable obstacles. I have arrived at the conclusion that there is one more service that has got to come into this and that is the folks back home, working through their voices in Congress, to remove some of the limitations which have been only briefly mentioned. As a representative of our Association here and with the perfect liberty to say what I please, I have undertaken to say it, and to bring to your attention some of the things that have impressed me as being of vital importance to this country. I have put my remarks on paper to be fairly sure of the people getting the chief part of them at any rate. This paper is entitled: "The Limitations and Posibilities in the Federal Care of Tuberculous Ex-Service Patients."

THE LIMITATIONS AND POSSIBILITIES IN THE FEDERAL CARE OF TUBERCULOUS EX-SERVICE PATIENTS

By David R. Lyman, M.D.

Wallingford, Conn.

The subject of the possibilities and limitations of the government handling of the tuberculous ex-service man, whether through the United States Public Health Service or the Bureau of War Risk Insurance, is one of such far-reaching importance and of so many aspects that I hesitate to attempt to set forth even its most important features in the time allotted.

Summed up somewhat tersely, the possibilities are the greatest perhaps we have ever had, while the limitations are at present so great as to make its successful solution under existing conditions appear almost impossible. This is a very strong statement but I feel that unless we look the facts squarely in the face and set ourselves to overcome the difficulties which now hamper us the result a decade or more hence will be found a tragic failure.

The past winter I had the privilege of being one of the men assigned under special temporary commission from the United States Public Health Service to make a detailed study of the various Service hospitals, especially in regard to their medical and social problems. The experience gathered in those studies and in conference with men who have been interested in this work throughout the country has confirmed me in the viewpoint which I have just expressed, and for which I shall endeavor to give my reasons.

At the outset, let me say that the lack of proper facilties for hospitalization has been one of the things which has led to the present condition. We promised the men in service that we would give the last word in hospital care and rehabilitation to those disabled and we failed to keep our word. This failure cannot be laid entirely at the doors of the Public Health Service. It is unfortunate that the government delayed for two years the decision as to what department was to have charge of this problem and that in consequence there was no adequate plan prepared in advance for meeting it; also that the American people were not more widely informed of the situation and its needs. Had these things been done the result might have been different. The facts are, however, that except for a ridiculously inadequate appropriation the early request of the United States Health Service for funds for this purpose went unheeded

and it has been compelled to care for the men with buildings and equipment totally inadequate and often unsuitable. The natural result has been that the country in general and the Legion in particular have had their time and attention so focussed on the provision of these sadly needed beds as to make all other considerations seem secondary.

We have at last, two years too late, reached the point where we are in a position to redeem our promise of adequate hospitalization; and it is an opportune time to take stock to see if we are getting the most of our present facilities, and if not, why not.

If one considers the possibilities offered in our government's plan for the care of these men, it indeed opens a fascinating field for the imagination. Our primary aim was, is, and should be, the complete rehabilitation, both physically and industrially, of the greatest possible number of these men and women and the last word in care and comfort for those for whom cure cannot be realized. In addition to this, there is the chance through educating these men in the care and prevention of tuberculosis and in basic principles of hygiene to exert a great influence on the future health of their homes and communities. We have, too, an unusual opportunity to further the education and interest of the medical profession in the whole subject, and finally, with the resources of our government at our command, to make use of the unusual facilities afforded by the grouping of large numbers of cases presenting all possible phases of the disease and under control for long periods of time, to make material contributions to our scientific literature on the subject.

Considering these possibilities in reverse order, I would say that the Service already gives promise of making good use of its opportunities for scientific study, but there is no time to enlarge upon that here, highly important as it is.

As regards the education of the physicians, I have in mind especially the facts that the Service has in every large town in the country some general practitioner acting as its representative. It has already begun to call these men in groups from time to time to the Service hospitals to be given, along with an insight into the regime of a sanatorium, brief courses in the diagnosis of tuberculosis and in the determination of what cases do or do not need hospitalization. This will not only have a marked educational benefit on these men and their communities, but in the prevention of unnecessary hospitalization will save the country many times the cost of their salaries, board and transportation. The heads of the Public Health Service are evidently awake to the full value of their opportunity along this line.

As regards the all-important function of the education of the boys in personal and public health, the Service is making great efforts to accomplish this. Dr. Hays, who had charge of this work in some of the army hospitals, is devoting his entire time to its development in the hospitals of the Service, lecturing to the patients and advising with the ward surgeons. The various well-known books for patients with tuberculosis are in all hospital libraries and the aids make every effort to give them

the widest possible circulation. The chief medical officers give health talks to large groups of patients in the assembly halls, and the head of the bureau in Washington and the medical officers in charge of the hospitals are constantly urging upon the ward surgeons the prime importance of making the widest possible use of personal and group conferences in order to make the most of the exceptional opportunities these hospitals afford for the dispersion of knowledge as to the principles of public health in general and of the control of tuberculosis in particular.

Coming back to the first, the most fascinating and most important object to be attained, *i. e.*: the complete physical and industrial rehabilitation of our tuberculous ex-service men and women, I am sorry to say that not only are we not in line to attain this now, but unless something is done to remove the limitations under which the government services are struggling, we face the certain prospect of failure. Here not only are we unable to lay the entire blame at the doors of the government services, but in fact must acknowledge that the fault is largely ours. In ideas as well as ideals, I see little to criticize and a great deal to praise in the plans of the Tuberculosis Bureau of the Public Health Service as put forth by Dr. Smith. The plain fact remains, however, that these ideals are being but partially realized and that we are not securing the results for which the Service is striving and which the public demands and expects. Why? The answer is to be found in the limitation of the Public Health Service's efforts both from official and civilian sources. There is no time to do more than mention among these the habit of our politicians of making political expediency and not national welfare the basis of action wherever individuals from their respective districts are concerned; the overwhelming amount of "paper work" required in government services; or even the silly inter-departmental jealousies and bickerings of which Washington seems unable to divest itself. Bad as these are, they shrink into small proportions beside the three great handicaps which are at present crippling our work. These are:

(1) An untrained medical staff;

(2) An almost total lack of coöperation from the men themselves;

(3) The failure of the public at large and of most of our volunteer service organizations, especially including most local chapters of the Legion, to understand the real nature of the problem itself.

The medical staff. To the statement that the Service has had to carry on its work with untrained medical officers, many people respond, "Why don't they get them?" The Service has been unceasing in its efforts to secure these badly needed officers and has combed the country, through the sanatoria, health resorts and the physicians in general practice, searching for men with special training in tuberculosis; but the plain truth is that they are not to be had; that is, in anything remotely approximating the number needed.

The first cause of this has been that we have all of a sudden multiplied the number of patients willing to accept sanatorium care far beyond our previous civilian sanatorium population, which itself has never been over-

staffed medically, but which has been our only source of supply for specially trained physicians. This fact has made it necessary for the government to secure as many highly trained men as they were able and to give these, in addition to their work of organization, the difficult task of training the men coming to the Service from the army or from ordinary civilian life.

This in itself constitutes a handicap that can only be overcome by arduous work extending over quite a length of time; for these men for the most part bring with them the viewpoint of tuberculosis usually held by the average general practitioner or surgeon.

As a clear understanding of this viewpoint and its marked difference from the real problem involved is necessary for a correct interpretation of the points I am trying to stress, I would ask your patience while I try to state just wherein lies this vital difference.

In ordinary life the patient consults a physician only for relief from acute or annoying symptoms, such as pain, cough, digestive disorders, etc. When these are once relieved he rarely returns until they recur. The physician on his part has his time so fully taken up with the relief of acute symptoms and sees so little of the chronic diseases except during the period when such symptoms are in evidence that he not only has as a rule not made a close study of chronic disease but has never become interested in it. In fact, he usually regards it as a nuisance; and in no malady is this more true than tuberculosis. The usual history of home treatment is that of a brief rest in bed followed by steadily decreasing office visits until the real danger point is reached; *i. e.*, as Babcock has so aptly said, *when the patient looks and feels perfectly well.* The visits cease; the physician credits himself with a "cure" and the patient returns to his old life blinded by a false sense of security, only to be awakened by a serious and often permanent breakdown. Neither realizes, any more than do the practitioners just entering the Service or the ex-service patients they are called upon to care for, that to treat tuberculosis successfully, both physician and patient must have the future always in mind. Our problem with the ex-service man (as with the civilian) is while we are getting active symptoms under control to be always looking toward the patient's after life, to teach him all we can of tuberculosis, and that to stay well he must learn above all things to figure the preservation of his health as one of the daily duties of his future industrial career. To accomplish this we must stimulate and help him to think in terms of that future career, searching meanwhile for the type of work consistent with the needs of his disability that will give him the highest earning capacity; for the scale of his living conditions and the use made of his leisure hours will usually decide whether or not the patient makes a final recovery. In other words, our problem is not merely to relieve the symptoms of these boys or to keep them contented. Our problem is to reconstruct their lives, to give them the physical well-being to hold their own in the industrial life of the community and to equip them mentally and industrially to an extent which will more than offset the physical disability

contracted in service. The occupational and pre-vocational therapy in the Service hospitals, joined with the wonderful opportunities offered the man with arrested disease through the Federal Board for Vocational Education, would, if available for the average civilian sanatorium, increase its number of permanently arrested discharged cases by at least 30 per cent.

They can never do this for the Service until the physicians entering its ranks from the army and from private life have been trained to the viewpoint I just mentioned, and this is a slow process. The Service is straining every effort to accomplish this and is deserving of high praise for what it has done and is doing along this line, but it will be a much easier and more rapid task if we can but remove the one greatest handicap of the work, and this is

The almost total lack of coöperation from the boys themselves.

This is where the tragedy of the situation lies. The very men whom we are planning and working and spending to cure are themselves affording the greatest handicap to our efforts.

The problem is the same as in civilian institutions only up to a given point. We have the same very human reaction against restraint of personal freedom, and we have the same tendency to interpret disappearance of symptoms as cure of the disease; but there the similarity ceases. In civilian life we have always to help us the incentive to the patient of the need of making the most of his opportunities so as to minimize the expense of treatment on the family finances and get himself back as soon as possible into condition to help support his family. In fact, our greatest handicap is that of preventing the patient from reassuming this obligation too soon. If the patient be inclined to shirk these obligations, the family usually can be relied upon to apply the needed moral suasion. Not so with many of the ex-service men. The government not only furnishes the treatment free but supplies them at the same time, through their compensation, with more money than many of the men ever had before over and above their living expenses. If we had provided that, beyond a limited amount for daily small needs, all compensation to men under treatment would either be paid to their dependents or else banked at interest to be turned over when the man was in condition to resume his industrial career, we would have done much more good to the boys and have avoided the positive harm the compensation has done in many cases. I know of one case where the local Red Cross paid the expenses of a woman from a little town in Florida to visit her husband in the Service hospital at Greenville. She arrived without possessions save the clothes she wore. The Red Cross at Greenville had been attending to the man's compensation claims and in the week his wife was there he received his check for back compensation, a total of over $1400. He immediately went to town, spent the entire sum on an automobile, which was kept in town for use when he had a pass, his monthly check furnishing funds for operating it, and the Greenville Red Cross clothed his wife and sent her home. I have known a bed case, who did not

want his bed put out on the porch, to use his compensation check for a trip of several hundred miles each way to lodge a personal complaint at Washington about it. One could multiply without end similar instances of the harmful effect of unrestricted compensation on individual cases, and it takes no keen student of human nature to understand why gambling is one of the chief problems against which the ward surgeons have to contend.

What chance is there under such conditions of bringing back to health the border-line case, whose only hope lies in long hard application to to a strict regime in which his health and future usefulness to himself and to his country is always kept the one great aim in view? Yet, what else can we expect of a large group of young men who don't feel sick, who don't realize that the real object of it all is to save their lives and not simply to satisfy their desires of the moment, and who have nothing to do and more spending money than the majority of them ever possessed before? Take one hundred men in any institution, civilian or service. Twenty-five per cent will of themselves have a serious realization of their condition and their obligations. There are, however, a smaller number who have none whatever and, either from lack of intelligence or self-control, will refuse to submit to the all-essential routine which alone can bring them back to health. The remaining great majority, through sheer easy-going thoughtlessness, will go as they are led and the irresponsible path offers the more pleasant appeal unless there be strong influences urging them the other way. With the "health slacker" uncontrolled, they will follow him, but if his pernicious influence be controlled or eliminated they will follow the serious-minded twenty-five per cent. back to health.

The two great problems with these boys at present are: first, the control of the group which refuses either to get well themselves or let the other fellow do so, and second, the men — and they are many — who establish the record of their disease in order to draw their compensation but who insist upon making their own decisions as to when they are well enough to go home, with the result that both they and the country at large must in future pay a heavy cost in suffering and in money because of their refusal to take proper care of themselves. I must add a third class, i. e., those who have sufficiently recoverd to go to work but will not avail themselves of the great opportunities offered by the Federal Board and who prefer instead to remain hospitalized, drawing their compensation. We do not question that it is our duty and our privilege to provide these men with the best facilities possible for restoring their health and re-establishing themselves in our industrial life, nor do we question any expenditure for the necessary support of their dependents meanwhile. Our obligation is freely acknowledged and will be carried out. But the whole of our country was in this war and not our army alone, and the men in their turn must be asked to realize and fulfill *their* obligation, which is that they do not jeopardize the health of their families and their communities, nor add needlessly to

the great expenditures we are making in their behalf by neglecting to make the most of the facilities that are being offered them.

The compensation should be used to bring these men to a realization of this and the man who will neither get well himself nor let others do so, the man who insists upon determining the method of his own treatment and the man who refuses to make an honest effort to use the industrial rehabilitation offered him when the medical advisers pronounce him fit, should all be subjected to a material and immediate reduction in compensation.

To treat them on the same basis as the conscientious man who is doing his full best, is fair neither to the latter nor to the country, and the mere knowledge of this reduction of compensation would act as a healthy deterrent to many men now throwing away their lives through ignorance or carelessness.

When one speaks of instances, and they are many, of men gambling, absent without leave, drinking — usually prompted by so-called "friends" while on pass— or major breaches of discipline, the question usually asked is, "Why aren't they fired?" I am glad to note the recent order limiting the number of times disciplinary cases may claim the privilege of hospitalization at the public expense. The truth is that up to now the government Services have not been able to call to their aid an informed public opinion which would back up their efforts toward maintaining this much-needed discipline. The great difference in the morale of the institutions or wards where those directly in charge have made a consistent fight for this makes one wish the same spirit had imbued the entire service, but it can be readily understood how extremely difficult it has been to find men with the rare combination of vision, backbone, medical training and instructive knowledge of how to handle men which would make it possible for them to overcome the existing handicaps. What gain to "fire" a man, only to have him readmitted to as many other hospitals as he cared to sample, (I know of one who has been in twenty-two), and usually demanding that the government or the Red Cross pay all his expenses enroute?

The third great limitation that must be removed is this lack of realization by the public that the real issues at stake are the lives of these boys and the future health and happiness of their families, and not simply that life be made pleasant and easy for them. The heads of the great organizations interested in the welfare of these boys realize this, but it is necessary for their local chapters, especially those of the Legion, for the many little volunteer social organizations in the boys' home towns and for the public at large to open their eyes to the real problems and to do so without delay. The day I visited one of the Service hospitals, I purchased a paper to read on the car and was greeted by this headline, "Head of Local Legion goes to Washington to demand more liberal treatment for men in regard to leaves of absence!" There was a column of the usual pathetic talk as to the hardship of the sick boys not being able to spend more time with their families and the general impres-

sion given was that the Service was needlessly harsh and even cruel in its restrictions.

The very first case record I studied at the hospital was that of a boy who had been there twenty-three days. In that time he had been absent a total of eight days, including two passes for over week-ends, while his record showed a temperature of over 100.5 on eight of the fifteen days he had consented to remain in the hospital, and his pulse had never been below 100! He should have been a strict bed patient fighting for his chance of life and if the Legion representative referred to, or the writer of the article, had either of them had the slightest conception of what the real interests of the boys demanded, they would have been printing columns even more strongly worded and criticizing the Service for laxity rather than harshness.

These limitations of lack of cooperation from the boys and lack of understanding of the public would make the best results impossible, even were the Service hospitals staffed with physicians thoroughly familiar with the handling of tuberculous cases. Where, as at present, most of the surgeons are new to the work and must be trained in these very hospitals, the obstacles are absolutely insurmountable.

We must open our eyes and those of the people back home to the fact that we are encouraging these boys to throw away their lives. We must, and this is most important, organize public opinion at home to influence our representatives in Washington to see that the pernicious hand of political preferment is removed from and kept off the selection of officers for responsible positions in charge of these men. We must organize and bring to the aid of the Service an educated public opinion that will result not only in the Legion, the press and the tuberculosis societies throughout the country placing themselves squarely behind the Service in its efforts to establish a regime which will restore these boys most surely to their full rehabilitation, but which will also put them in the position to criticize intelligently the work of the government hospitals and to insist upon their being maintained at the higest possible standard. Unless and until we do this, we face the certainty of a future death rate among these boys that will stamp our work for them, as I stated in the beginning, as a tragic failure, the responsibility for which we cannot shift over to the shoulders of the Public Health Service.

"On our own heads, in our own hands
The sin and the saving lies!"

The Chairman: I want to ask you to stay a moment in respect to one who should have been the final speaker on our program. We have lost one of the strongest crusaders for the treatment of ex-service men in our hospitals. The sudden and violent death of Commander Galbraith not only deprived us of hearing straight from the heart of the Legion and from the Committee on Hospitalization which has been such a powerful agency for correcting some of the difficulties which Dr. Lyman has mentioned, but we lose the opportunity of having given to us here

something of the spirit of the man who has tried manfully to do in these hospitals what a layman can do in building up discipline and morale. Colonel Galbraith went to these hospitals and addressed the men individually and collectively, and I believe there is not a Commanding Officer of government hospitals who would not testify that his presence very greatly strengthened the discipline and morale and the control over the patients by the officers in charge of those hospitals.

In every instance, although he was out to get service for his fellow-legionaries, he came to us as the most powerful agent of public opinion in attempting to bring the morale to a point which public opinion failed to attain through the usual channels.

I want to pay my personal tribute to Colonel Galbraith as one of that devoted group of individual agents working with the Congress to see that the public agencies had what they needed and that politics were set aside so that the outlines of the work should be clear, and so that the needs could be met and met promptly. We believe we have lost a very valuable asset in our campaign for the tuberculous ex-service man.

I should appreciate it, if you all feel the same way that I do, if you would rise for a moment in respect to Commander Galbraith. I know the Legion would appreciate this tribute.

(*The audience rose in respect to Commander Galbraith.*)

In closing, I want to say just one word in regard to what has been emphasized by Dr. Lyman. Truth is the only thing we need now and we need it desperately. When a United States Senator can get up in the Congress and say in public and have printed in the Congressional Record that twenty thousand poor ex-service men are sick and need care and have not obtained it, there is mischief and ignorance afloat in the land. That is a false and mischievous statement, and that statement has been made within the last few weeks. It has been published in diagrammatic form and with catchy arguments has been widely quoted. There is not a man whom we have not been able to hospitalize for many months past. We have not always had at the particular point or in the particular hospital a bed service especially adapted to a particular kind of disease everywhere in the United States, but we have now from three to four thousand vacant beds in the various government hospitals, where we can now hospitalize these men. That is about nineteen per cent vacancies in the government hospital system. That is a reasonable and proper margin or a margin of safety. There are not twenty thousand men who need hospital care and can not get it. There is no one who can produce them or give their addresses. All men applying for hospital treatment are being hospitalized with a reasonable promptness and it is to correct such mis-statements and misunderstandings that we look to you and to your powerful public influence through the agencies that you have at your disposal.

I want to correct also the impression that there is need of the pitiful public appeals to the pocket-book for the ex-service man. I have seen placards in public stores asking for money to help ex-service men get

what I know the Government is providing for them. It is an appeal that should not be made. We can not properly mix sentiment and sanitation, politics and pathology. We should make some distinction between the art of politics, the science of pathology and the practice of finance. I want to ask you to make clear in your own minds and in the minds of the people whom you touch throughout the country that what is needed is truth and honesty and after that the words are "Steady and all together." The resources of the country are sufficient to meet the situation, even though for a time we have been staggering in the face of what I may call a malign emotionalism. We have got to get down to science, service and facts.

I don't believe there is any group of people who have handled the facts in respect to public education in a more thorough manner than the National Tuberculosis Association, whether it be in the hospitalization work or in the unselfish work of that group consisting of Mr. Kidner, Dr. Pattison, Dr. Hatfield and other officers of the Association or through individuals. We have obtained constant and increasing support and an intelligent direction of policy from the National Association and on behalf of the Departments of the Government Service, I wish to thank you all and take this opportunity for saying what our appreciation is of the service which you have given us. I thank you.

CLINICAL SECTION

Chairman

JAMES ALEXANDER MILLER, M.D.

New York

Secretary

HENRY T. CHICKERING, M.D.

New York

DI CHLORAMINE T IN TUBERCULOUS ABSCESSES

By Edward J. Murray, M.D.

Lexington, Ky.

In the treatment of surgical tuberculosis, whether of the glands or bones, and in all cases of tuberculous abscesses, the number of actual *bona fide* cures is small, in proportion to the actual number of cases under treatment. Every form of treatment has been tried, surgical, medicinal, heliotherapy. Some swear by one, some swear by the other, but the existence of so many various "cures" proves that no real one has been found. Since the beginning of the World War in 1914, many disinfectants and germicidal solutions have sprung into existence. The most popular that has survived the test of time, is Di Chloramine T.-Toluene-Parasulphondichloramine.

In the summer of 1918, a patient was sent to the Blue Grass Sanatorium for treatment of pulmonary tuberculosis. She informed us she had been receiving treatments from a local surgeon for a rectal abscess. We communicated with the surgeon and he informed us he was using daily applications of five per cent. solution of Di Chloramine T. The results of the treatment were so good, that we investigated and endeavored to learn something about it. Up to date, we have been unable to find any literature upon the use of Di Chloramine T solutions in tuberculosis. A personal communication from Dr. Walter Estell Lee states that he is now trying out this form of treatment in Philadelphia.

Since July, 1918, we have used this treatment in every case of tuberculous abscess encountered. In all, we have treated sixteen patients, and while the number of cases handled is too small for us to draw any definite conclusions, some interesting features presented themselves.

The solution used was a five per cent. solution of Di Chloramine T. The preparation of the solution is as follows: "A mortar of sufficient size is cleaned with soap and water and dried. The pestle and the bottle to be used for the finished product are treated in the same manner. Place a small quantity of chloroform in the mortar, covering all of its surface, and allow it to dry in the air. Place the proper amount of Di Chloramine T powder in the mortar. Enough chloroform is added to dissolve it, making a clear solution, and the solution is allowed to evaporate in the air leaving the fresh Di Chloramine T powder. When sure all the chloroform is evaporated, add about ½ the necessary amount of Chlorcosane, constantly stirring with the pestle, until all of the powder is dissolved. Then slowly add the rest of the Chlorcosane. Pour into amber colored glass stoppered bottle and keep in reasonably cool

place."[1] If the precautions enumerated above are taken, the solution will last sometimes for several months. When ready to use, pour out of the bottle into a small medicine glass, and never insert swabs, or anything else into the original stock bottle. Unused solution should be thrown away, and never put back into stock bottle.

"Di Chloramine T is a non-irritating synthetic germicide"[2] and is very easily applied. In small surface abscesses, we thoroughly cleansed the wound. The Di Chloramine T solution was poured on another swab and the wound was thoroughly mopped. For deep-seated pockets and in old sinuses, we injected the solution. For deep injections, we used a Lee and Furness attachment on an ordinary Luer type all glass syringe. A small soft rubber catheter may be used in introducing the solution into very small sinuses. An all glass atomizer can be used to spray the solution on superficial wounds. We have not had occasion to use the last two methods enumerated.

It is quite generally accepted that it is bad surgery to open up tuberculous abscesses indiscriminately, but often it is absolutely necessary. The sanatorium physician usually gets the patient after the abscesses have been opened, and have been discharging for some time. In the series of sixteen cases upon which this report is based, we opened only four ourselves; the remaining twelve were wide open and discharging beautifully, when we first encountered them. We aspirated all deep-seated pockets and then injected the solution.

The wounds were treated only once every twenty-four hours, and the wound was dressed by simply covering with a pad of sterile gauze. At first, we used sterile cotton inside gauze covers, but have changed to simple gauze dressings. There is no discomfort with this form of treatment, though some complained of a burning sensation when the solution was first used, but this discomfort wore off within an hour. The amount of the solution used at each dressing varied, but we completely filled every cavity, no matter how deep. In some cases, two openings were made, especially when the pockets were not very deep-seated, and the wound was thoroughly flushed from above with Di Chloramine T solution. When this had drained out, we temporarily plugged the lower openings, filled the cavity from above, and applied dressing over all. In one case, we found a sinus opening into the mouth through the parotid gland connecting exteriorly with a large cervical abscess. Even in this case, we thoroughly filled the pocket, and as the opening into the parotid gland was very small, it closed up within ten days with no further discomfort.

We encountered some burns on the skin surrounding the wound in our first few cases, but soon discovered that the use of cotton sponges was responsible. We are unable to say why this happened, but some chemical reaction must have taken place, when the cotton came in contact with the Di Chloramine T solution. Discontinuing the use of cotton sponges stopped the trouble.

The presence of secondary organisms in the discharges of tuberculous

abscesses is well established, and these cases should be handled as non-tuberculous infected open wounds. These cases are already infected, and our duty now is to control the infection. "Success in disinfection by germicides is dependent upon three conditions already demonstrated by Dunham: 1. Actual contact of the germicide with the infecting organisms. 2. The maintenance of such contact for a sufficient length of time. 3. An adequate mass, or concentration of the agent at the points of contact. Di Chloramine T has been found to be a germicide which possesses to an unusual degree, the properties that make it possible to meet the conditions which Dunham says govern the success of disinfection: contact, time, mass." [2]

Of the sixteen patients upon whom we tried this form of treatment, the pulmonary condition of three was far advanced; moderately advanced in eleven; incipient in one; and in one case no definite diagnosis of active pulmonary tuberculosis could be made. The tuberculous conditions treated with the Di Chloramine T were as follows: three ischiorectal abscesses; four sinuses in hip; four deep cervical abscesses; two abscesses in axilla, two abscesses just under the clavicle, and one patient had a sinus in the right thigh and one in the stump of an amputated left limb at the thigh.

In every case, we found secondary organisms and all showed the presence of tubercle bacilli in the discharging pus. The secondary organisms disappeared in every case, and we were unable to demonstrate tubercle bacilli in smears after a month's treatment. Guinea-pig inoculations were not available when smears were free of tubercle bacilli. Inoculation proved all abscesses were tuberculous at the beginning of the treatment.

Within a week's time, we noticed that the character and amount of pus had changed. Instead of the thick, sometimes cheesy, yellowish mixture, we had a thin straw-colored discharge. All odor had gone excepting the appreciable chlorine odor of the Di Chloramine T. We noted also, that there was a disintegration of fat, and fat globules appeared in the discharges. When the change in character of the discharge became marked, we cut down the strength of the Di Chloramine T solution one half.

When the abscesses were practically free from pus, we omitted the daily treatment with the Di Chloramine T, and simply swabbed, or irrigated the wound with sterile normal salt solution. This was continued only for two or three days, and was used as a "check" on the condition of the wound. If the condition showed signs of improvement, we modified the strength of the Di Chloramine solution accordingly. If the discharge became worse, we went back to our original strength of Di Chloramine T. By this method, we gradually reduced the strength of the solution until the wound healed over.

It is the unanimous opinion of our present day reputable surgeons and tuberculosis specialists, that tuberculous abscesses and old sinuses are usually local manifestations of a general disease. Not only must the

local condition be treated, but the under-lying focus sought for and a general constitutional treatment outlined. We were able to get some of our cases to enter the sanatorium for treatment; nine, however, were not treated in the sanatorium.

We have classified our results under two headings; i. e. those who were taking sanatorium treatment, and those who merely came to the office for attention. The institution patients were treated daily, but those coming to the office were not faithful and failed to come regularly. Their average treatments were once every three and one half days.

In classifying our end results, we have used for the pulmonary lesions the standard classification adopted by the American Sanatorium Association for discharged patients, which is familiar to all present. For the tuberculous complications, we used the temporary classification for cervical adenitis, recently published by Hyde and Lo Grasso,[3] as follows:

Apparently Recovered: Cases in which all symptoms such as fever etc. have disappeared, and all abscesses and ulcers have healed. The lymph glands must be impalpable, or reduced to nodelike enlargements. This condition is to have existed without any return of symptoms or signs for at least three months.

Arrested: Cases in which all symptoms have disappeared, and all abscesses and ulcers show no evidences of activity, or have healed, and the glands have been reduced, but not necessarily to nodelike enlargements.

Improved: Cases in which all symptoms and signs show evidence of improvement.[4]

Our end results for the seven cases handled in the sanatorium are as follows: The pulmonary condition of four was "improved" upon discharge; in three the pulmonary condition was progressive, and they have died since leaving the institution.

From the tuberculous complications treated with Di Chloramine T, four have "apparently recovered." In the other three cases, there was no material improvement noted, except the removal of the obnoxious odor and the relief afforded the patient. These three cases were the three patients who died shortly after discharge. We made life more pleasant for them, therefore we consider we accomplished a great deal. The average length of time under treatment for those "apparently recovered" was 101 days, for those "unimproved," 83 days. Another patient now undergoing treatment in the sanatorium is not listed in this series of sixteen cases, though his condition shows daily improvement.

Of the nine cases treated in the office, we have the following to report: The pulmonary condition was "improved" in four cases, and was unknown in five cases, as they disappeared soon after treatments were started, and their present whereabouts is unknown.

From the tuberculous complication, one has "apparently recovered," one left after a month's treatment, showing no improvement, and refused to continue: two patients are still being treated and show some

improvement. The condition of the five whose addresses are unknown, we are unable to say. Average length of treatment for the "apparently recovered" case was 124 days; for the one who discontinued treatment, 34 days; for the two still being treated, 51 days, and for the five who have disappeared, 27 days.

A study of these two classes of cases certainly convinces one that local treatment is not everything. Our sanatorium cases were the worst ones, yet they showed the best results, and surely this is not merely a coincidence; sanatorium regime had something to do with it.

At the present time, June 1, 1921, an average length of 381 days after completion of the treatment, the five patients classed as "apparently recovered" show no signs, or symptoms of pulmonary activity, the abscesses appear completely healed, the patients look well, feel fine, and report they are working full time every day. In none of our sixteen cases was any other form of local treatment used.

CONCLUSIONS

1. This series of cases is too small to have any bearing upon such an important subject.

2. Di Chloramine T is no panacea for tuberculous abcesses, but it has proved a help.

3. In this series of sixteen cases, five have "apparently recovered"; two are "improved," three showed no improvement, and six have voluntarily stopped treatment.

4. Those under sanatorium treatment made better cures than those treated in the office.

5. Di Chloramine T is well worth a trial in all tuberculous abscesses, as it does destroy the secondary organisms, remove obnoxious odors, and affords the patient a great deal of relief.

6. More work must be done to prove anything definite in the use of Di Chloramine T in tuberculous abscesses.

7. This paper is presented for the purpose of arousing interest in this subject, so that the method may be given a thorough trial and thus we may ultimately learn something of its merits in the treatment of tuberculous abscesses.

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THE MANAGEMENT OF PLEURAL EFFUSIONS IN THE COURSE OF THERAPEUTIC PNEUMOTHORAX*

By Barnett P. Stivelman, M.D. and Joseph Rosenblatt, M.D.

Bedford Hills, N. Y.

Experience teaches that pleural effusions may be expected in a large proportion of cases treated with pneumothorax. The exact percentages given vary directly with the length of time the patients remain under observation and the frequency with which roentgenologic studies are resorted to. In our series we encountered effusions in over fifty per cent. of cases. Opinions differ as to the effect of these effusions. Most early workers in this field considered them as pernicious complications. With increasing experience, however, their presence is looked upon with less apprehension; in fact some observers maintain that serous effusions are salutary phenomena, their beneficial effects being due to antibodies they engender and to the more efficient and uniform lung compression they produce. But whatever their beneficial effects be due to, there is hardly a doubt that once the acute symptoms have subsided, a definite, if only temporary improvement is noted in most cases and very few are the worse for their experience.

It is however, of great importance to consider the ultimate results of these effusions rather than their immediate salutary effects. Many observers are of the opinion that inflations should be discontinued in the presence of the effusion because they believe that the antibodies they contain and the efficient and uniform pressure they exert on the lung are sufficient to produce satisfactory therapeutic results. Others are profuse in their praise of Debove's autoserotherapy to promote the rapid absorption of the pleural exudate.

Careful observation of a large number of cases, however, discloses the fact that these effusions are erratic in their behavior. In some instances they will accumulate in large quantities, markedly displacing the mediastinum, breaking up adhesions and laying open walled-in foci which may produce pyopneumothorax. On the other hand, the fluid may be rapidly absorbed, leaving behind numerous adhesions which ultimately cause obliteration of the pleural cavity. The rapid absorption of the exudate and the consequent obliteration of the pleural cavity are even more disastrous in their results than the undue accumulation of the fluid, especially if the obliteration occurs early in the course of the treatment,

*From the Montefiore Home Country Sanatorium, Bedford Hills, N. Y.

when the diseased lung re-expands rapidly, its cavities re-open and a recrudescence of the disease is rendered inevitable. It is evident, therefore, that the expectant form of treatment is not based on sound, scientific principle.

No hard and fast rules can be laid down as to the management of these effusions and success or failure most frequently depends upon the care exercised and the judgment used in the management of the individual case. Nevertheless, it occurs to us that the indications for treatment can be brought out in a more comprehensive manner by subdividing all cases of effusion into several groups, depending upon the quantity, character and behavior of the exudate.

I. SMALL FLEETING EFFUSIONS

This group consists of those cases, which, in the course of treatment, without acute symptoms, developed small, fleeting effusions, enough to fill the costophrenic sinus. These effusions are of no consequence because they are transitory in character and are promptly absorbed. They do not affect the intrapleural pressure and are discovered only on fluroscopy, with the patient in the erect posture. These cases need no special treatment and the inflations can and should be continued as if no effusions occurred. Such cases are not included in the number of pleural effusions of the series herewith recorded, but they occur very frequently if carefully looked for.

II. MODERATE SIZE SEROUS EFFUSIONS WITH NO TENDENCY TO UNDUE ACCUMULATION

This group includes cases with a moderate amount of serous fluid, reaching the fifth or fourth rib anteriorly. The development of these effusions is ushered in by more or less acute symptoms such as pyrexia, malaise, pain in the chest and increased cough, lasting about four to seven days. After the acute symptoms abate, these patients show considerable improvement and their general condition is usually better than before the development of the effusions. In these cases the effusions show no tendency to rapid accumulation and there is only slight or no displacement of the mediastinum. The intrapleural pressure, however, is definitely affected and the introduction of small amounts of gas will cause a marked rise in tension. The indications for treatment in this group of patients are to maintain a satisfactory collapse and to prevent the formation of adhesions and retraction of the pleural cavity. Aspiration is rarely necessary because the fluid usually shows a tendency to spontaneous absorption. But the patient should be carefully watched roentgenologically and otherwise and the pneumothorax should be continued with increasing intrapleural tension. If the pleural cavity shows a tendency to retraction and the mediastinum is pulled towards the treated side, the intrapleural pressure should be slowly increased to about thirty millimeters of mercury.

In our series we encountered ten cases of this kind. Six of them who are treated by continuation of the pneumothorax under increasing intrapleural tension are doing well. They have now been observed from six months to two and a half years, and so far we have been successful in maintaining a satisfactory collapse in all and the fluid has been absorbed in five. In the remaining four patients the pneumothorax was discontinued soon after the development of the effusion, in the belief that the fluid will prove an efficient means of maintaining the collapse. In these cases extensive adhesions and obliteration of the pleural cavity took place and a recrudescence of the disease occurred.

III. LARGE, RAPIDLY ACCUMULATING SEROUS EFFUSION

To this group belong cases who develop copious effusions, filling the greater part of or the entire pleural cavity. The symptoms at the onset in these cases are similar to those described in Group No. 2, but in addition there may be considerable distress due to the pressure of the great volume of fluid and the marked displacement of the mediastinal contents. The indications for treatment in this group are to relieve pressure symptoms, maintain the collapse of the lung as well as to prevent pleural adhesions. The fluid should be aspirated and replaced by air, even if the pressure symptoms are not severe, because it is practically impossible to retain control of the pneumothorax in the presence of large volumes of effusion, and when this control is lost, pleuritic adhesions and obliteration of the pleural cavity will result. The aspiration and gas replacement operation should be continued until there is no more tendency to reaccumulation of large amounts of fluid. The pneumothorax, however, should be continued indefinitely and the intrapleural pressure should be left at about zero so long as the mediastinum is displaced to the opposite side. But as soon as there is evidence of displacement of the mediastinum to the affected side and contraction of the pneumothorax cavity is noted, the intrapleural pressure should be gradually increased, and many cases do well when the pressure is permitted to reach plus twenty to thirty millimeters of mercury.

We had eleven cases who can be included in this group. Seven of these were treated in the manner just described while in the remaining four the pneumothorax treatment was discontinued on the advent of the effusion. Of the seven cases treated, five who have been observed for from one to two and a half years, have been discharged with the disease apparently arrested. Their pneumothorax is still continued and in four the fluid has been completely absorbed. Two patients did not benefit by this treatment on account of the extension of the lesion on the untreated side, which, in our opinion, had nothing to do with the development of the effusion. In the four remaining cases of this group which were not subjected to aspiration and readjustment of the intrapleural pressure, obliteration of the pleural cavity and opening up of ulcerating cavities have taken place, causing fatal hemoptysis in two and rapidly progressing lesions in the others.

IV. STERILE PURULENT EFFUSION — BENIGN EMPYEMA

In this group are included cases who develop considerable effusion, which promptly becomes turbid or purulent, but no tubercle bacilli or any other organisms can be found on direct smears of the fluid. The symptoms at the outset may be more severe than those accompanying serous effusions, but after the acute symptoms subside, the patients usually do well. Jacot calls these effusions "benign empyema." In these cases there is a decided tendency to organization of the exudate and obliteration of the pleural cavity. The fluid should therefore be aspirated and replaced by air and the pleural tension should be gradually increased. Four of our cases, who have been observed from one to three years, belong to this group. In two, re-expansion of the lower lobe took place in spite of energetic treatment, but we succeeded in keeping the diseased upper lobe collapsed. All the four patients are doing well and are working part time. In two cases the fluid has completely disappeared and tubercle bacilli can no longer be found in their sputum.

V. TUBERCULOUS PYOPNEUMOTHORAX

To this group belong cases who develop a tuberculous empyema, usually as a result of laying open a tuberculous focus in the pleural cavity. The symptoms at the onset are very severe and the patients are dangerously ill for months. Smears from the pus aspirated show numerous tubercle bacilli and occasionally a few secondary organisms are detected. In these cases, as much of the pus as is possible should be aspirated and replaced by air. The injection of two to three cubic centimeters of saturated alcoholic solution of methylene blue into the pleural cavity through the aspirating needle seems to be of great benefit in the treatment of these cases. We are not yet ready, however, to say in what manner the methylene blue acts. Two of our cases which have been treated in this manner for over a year show remarkable improvement. They gained considerable weight and strength, their sputa are negative for tubercle bacilli and they are now able to perform the greater part of the work they used to do before their illness. These two cases will be reported in detail elsewhere.

VI. PYOPNEUMOTHORAX DUE TO MIXED INFECTION

This group includes mixed infections by virulent pyogenic organisms, introduced from without or through a perforation of the lung, or as a part of general infection. The prognosis is usually grave but of late some reports indicate that good results are obtainable with rib resection followed by irrigation with Dakin's Solution.

COMMENT

A classification of effusions in the course of therapeutic pneumothorax from the etiologic and pathologic point of view has been described in a very comprehensive manner by Von Muralt. Our aim here is to outline

only the general principles which govern the management of the various groups of cases. We must emphasize, however, that these are merely general principles and can be applied intelligently only when each individual case is carefully considered and repeatedly subjected to thorough roentgenologic examinations. For it is only then that we can be definitely informed of the accumulation or absorption of the fluid and the position of the mediastinum.

The position of the mediastinum is the important guide in the treatment of these effusions. A mediastinum markedly displaced to the untreated side indicates that the fluid is accumulating and that the intrapleural pressure is higher than the correct treatment of the case demands. Aspiration and substitution of air, with a final intrapleural pressure of about zero, is the best method of treatment in such cases. On the other hand, when the mediastinum is pulled toward the treated side, it is an indication that a fluid is in the process of absorption and that shrinkage and obliteration of the pleural cavity is threatened. Here creation of high intrapleural pressure is indicated.

The technique of aspiration and substitution of air hardly needs to be gone into at the present time. Suffice it to say that in order to avoid such symptoms as fainting, nausea, palpitation, during the aspiration, it is advisable to do the aspiration and the inflation simultaneously. The needle connected with the Potain aspirator is inserted in the most dependent portion of the chest and the pneumothorax needle is inserted above the level of the fluid. In this way air is introduced while the fluid is being aspirated, thus preventing marked changes in the intrapleural pressure and rapid shifting of the mediastinal organs, which are responsible for untoward symptoms that are especially likely to occur when large amounts of fluid are removed.

SUMMARY

1. The immediate effects of serous effusions occurring during pneumothorax treatment are usually beneficial, but ultimately they cause premature re-expansion of the lung and obliteration of the pleural cavity. It is therefore unwise to discontinue the treatment and adhere to the dictum of "leave effusions alone."

2. Small, transitory effusions, which do not alter the intrapleural pressure, require no special attention.

3. Moderate effusions which do not displace the mediastinum and do not interfere with the continuation of the pneumothorax, need not be aspirated, but the pneumothorax should be continued with increasing intrapleural pressure to prevent obliteration of the pleural cavity.

4. Large effusions should always be aspirated and substituted by air and the pressure regulated according to the needs of the individual case.

5. Purulent effusions should always be aspirated and replaced by air, not only because of their toxicity, but also on account of their tendency to produce extensive adhesion formation and obliteration of the pleura.

DISCUSSION ON PAPER BY DR. STIVELMAN AND DR. ROSENBLATT

Dr. Ethan A. Gray, Chicago: The last point made is one of the most important of the paper. In the aspiration of large quantities of fluid (not referring to acute pleuritic effusion or acute hydrops) a serious factor may exist in the rapid change which occurs in the positions of the thoracic organs. Also, without question, in a rapid aspiration, the circulation of the chest will be sharply influenced. Aside from the great subjective distress which may be produced, one should not forget that bronchorrhea may supervene. Such a phenomenon may be rapidly fatal.

I speak, fortunately, from one experience only. In this case, the aspiration of some 400 or 500 c.c. suddenly was followed by cough and profuse expectoration. The patient became dyspnoeic and cyanotic. Prompt refilling with nitrogen to a manometric positive gave immediate relief. That was among my earlier experiences. Since that time I have never taken fluid from the chest without simultaneously or intercurrently introducing gas or air. The first symptom, I find, of importance is a feeling of pressure (not distress) under the sternum; I then switch to the gasometer, and give gas until the patient feels thoroughly comfortable again. In this way large quantities of fluid can be removed if necessary.

The point which I get from the paper is that constant watchfulness is the keynote in the treatment of these effusions, and not one of us can have any quarrel with this. Many of our cases go along for months very comfortably, while the results are distinctly favorable in most cases. Fortunately, very few cases, if we were to tabulate them, would be found to result in anything at all alarming. We should check up, not with the fluoroscope, because it does not tell us enough, but with the x-ray plate, which tells us a great deal.

Autoserotherapy may be resorted to by the aspiration of 10 or 20 c.c. of serum to be immediately injected under the skin. Where I have been able to determine the presence of tubercle bacilli, I have several times discovered that I had a cold abscess at the point of injection. That, however, does not make any trouble and may be cleaned up with a little bismuth.

On the whole, I do not feel that the effusion in itself is anything of a particularly alarming nature.

Dr. J. F. McConnell, Colorado Springs: I think we ought to emphasize the remarks that were made by the essayist, particularly in regard to the necessity of constantly watching these patients and of individualizing. Since 1912 I have been using pneumothorax and have had the usual number of effusions. Some of them have been very troublesome. Where the effusions were very large I followed pretty much along the same lines that were so well presented in the paper.

I would like to speak about the use of tuberculin in getting rid of these effusions. If any one has been made a therapeutic nihilist in regard to the use of tuberculin, he can see remarkably splendid effects in the treatment of these cases.

I have used the dosage recommended by Dr. Cohen of Philadelphia. Practically, I have gone beyond that, even as far as 20 ciphers in dilution, controlled by diluent exhibited in other patients. The results in nearly 100 cases have been uniformly good. I do not want to go on record as saying that every one is going to get these results because I am mindful of what has happened regarding the use of digitalis in pneumonia — the first man who used it reported that in 100 cases the results were most satisfactory, but he happened to strike a number of patients with fibrillation. Others may not have been equally successful in having pleural effusions absorbed by this treatment; however, I will say that in my hands the results have been most happy, so much so that some of my confrères in Colorado Springs have frequently referred to them as coincidences.

So I would ask you to try it. However, the dose must be small, it must be the optimum dose, it must not be repeated as long as the effusion is showing signs of disappearance. Perhaps not all of the effusion will go, but the large effusions will rapidly disappear under the influence of tuberculin.

Dr. Emanuel Singer, Liberty, N. Y.: I think we are all very much indebted to Dr. Stivelman and Dr. Rosenblatt for their very interesting paper on the management of these pleural effusions.

I think that all of us who have used pneumothorax therapeutically have had difficulty with the effusions. We certainly cannot differ in the main in the management of these effusions. The interesting point that Dr. Stivelman spoke about is the use of the aniline dyes, especially methylene blue, in pyopneumothorax. The use of these dates back to quite a number of years; recently it was revived and I was very much interested in the recent paper of Dr. Waters of Loomis, on this subject. One of the points that Dr. Waters brought out in the use of the gentian violet was that it more or less corroborated the findings of Dr. Petroff. It seems to have no material effect when the pyopneumothorax is due to the tubercle bacilli as the tubercle bacilli grow well on a gentian violet medium. Its most efficient work seems to be when the effusion is due to a secondary organism.

I have had one experience with the use of it. It was purely a tuberculous effusion and following a spontaneous collapse. The results were, I can say, mostly mechanical. It seems to have diluted the pus and made the effusion aspirable, but the bacilli remained and were virulent and purulent fluid always recurred producing symptoms. I think another point that might be brought out in the use of aniline dyes is a warning against the use of a very large bore needle, because sinuses are more apt to follow, and in my case quite a large cold abscess followed. I think the smaller bore needle is the choice in aspiration. Though gentian violet and methylene blue may have a bactericidal effect on the purulent effusions of secondary organism, yet I believe it still remains to be proven if it has real bactericidal value in the tuberculous purulent effusions uncomplicated by secondary organism.

Dr. Lawrason Brown, Saranac Lake: I want to thank Dr. Stivelman for this paper in which we are all very much interested.

There is one point about very high pressure that we ought to bear in mind. I have had one unfortunate case where I left plus 20 to plus 30 cm. of water at the end of the treatment and the patient got a rupture of the lung and died. I think you have got to bear that possibility in mind.

I would like to ask if I heard correctly that the gentleman here uses decimal point 20 zeros and then the dose of tuberculin?

Dr. McConnell: Yes.

Dr. Brown: He certainly uses tuberculin in homeopathic doses. I would like to ask if he has tried to control those cases at all with salt solution. My experience would lead me to believe that salt solution might do almost as much good as those very small doses of tuberculin.

Dr. Stivelman: Referring to the methylene blue, I would say that we used it in cases in which we could not find a secondary organism. It has been shown that methylene blue and other dyes have some definite action in inhibiting the growth of the tubercle bacillus. This is all we can say about the action of this dye substance.

We injected the pus aspirated into guinea pigs, one of which was killed at the end of eight weeks, and no tubercle lesions could be found microscopically. The guinea pig injected with pus aspirated from the second case is still alive, so that we do not yet know what the methylene blue has done in this case.

In the injection of the methylene blue and the production of pneumothorax, we have used the anesthetizing needle only. Both the primary and subsequent inflations are done with the small needle. In fact, we get excellent oscillations, and in the thousands of injections made in the past four years, we never found difficulty with the small anesthetizing needle.

Referring to the pressure, I would say that plus twenty to thirty millimeters of mercury is not reached at once. We arrive at the higher pressure very slowly. We usually begin with zero or minus and it is only after many months and years, that we reach the high positive pressure.

In this connection, I wish to call attention to an addition to our apparatus. We have attached to our pneumothorax apparatus besides the water manometer, also a mercury manometer, so that we can go as far as we like in regard to the intra-pleural pressure without having recourse to an additional instrument.

THEORETICAL EXPLANATION OF THE FORMATION OF ROENTGENOGRAPHIC PLEURAL ANNULAR SHADOWS*

By J. Burns Amberson, Jr., M.D.

Loomis, N. Y.

In presenting a short abstract of this study of roentgenographic pleural annular shadows, attention will be directed to their clinical bearing and anatomical significance. A preliminary brief review of the investigations of Sampson, Heise and Brown[1] is necessary. These workers found the incidence of such shadows to be 11.8 per cent. in 423 consecutive cases and concluded that they indicate lung rupture with subsequent partial pneumothorax, localized because of the presence of adhesions. They found the prognosis less favorable in such cases. Seventy per cent. of their shadows were located above the third rib, usually in one of the interlobar fissures. In some of the shadows a lower horizontal shifting level was seen which was taken by these authors as fluid in the presence of air and which suggested to them the lung rupture theory. W. A. Evans[2] agrees with the Trudeau investigators but Honeij[3] considers annular shadows as signifying a simple pleural inflammation. He does not state the grounds for his belief.

At the Loomis sanatorium a considerable number of these shadows have been observed but this particular study is based on a series of 49, all of which were followed by serial stereoscopic roentgenograms and contemporaneous clinical records. The investigation has confirmed the findings of Sampson, Heise and Brown regarding the general character and location of the shadows but has brought out several new facts and has led to different general conclusions. The former may be stated briefly as follows:

Pleural annular shadows develop in cases of pulmonary tuberculosis only in the presence of active disease; they do not appear where there is demonstrable roentgenographic evidence of retrogressive disease.

These shadows grow larger only when the disease continues to be active; they do not enlarge where the disease is retrogressive.

These shadows grow smaller or disappear only when the disease becomes retrogressive; they do not diminish in size when the disease continues to be progressive.

Shifting fluid is present in a certain percentage of the shadows: this was never observed to occupy more than one-third the area of the shadow

*An elaboration of this study will be published by The American Review of Tuberculosis.

and may be so evanescent as to disappear entirely in the space of two or three days. Fluid appeared in this series only where there was evidence of active disease.

As many as five annular shadows have appeared, one after the other, in a single case in a space of seven months. In this as in other instances the clinical course was what may be termed typically pleuritic.

Where there is evidence of continued, active disease the shadows may persist for one year or more.

As opposed to other views, this study leads to the belief that the development of most pleural annular shadows indicates simple subacute or acute pleurisies.

The following evidence tends to weaken the contention of Sampson, Heise and Brown that the shadows indicate lung rupture:

Reliable clinical and pathological reports show an incidence of lung rupture in pulmonary tuberculosis of from 5 to 10 per cent. At the Brompton Hospital[4] it varied from 6.4 to 8.2 per cent.; at the Phipps Institute[5] it was 7.3 per cent., while Landis[6] is of the opinion that pneumothorax may be expected in about 5 per cent. of all cases. At Trudeau the incidence of annular shadows was 11.8 per cent. Add to this all cases of recognizable, massive lung collapse due to perforation and there results an incidence that is much in excess of that shown above. Indeed, I am prepared to suggest that if every case of active pulmonary tuberculosis were followed by serial roentgenograms over long periods of time, the incidence of pleural annular shadows would be found surprisingly high. Remembering that they appear only as an accompaniment of active disease, their occurrence in this special group must be acknowledged as higher than that of manifest spontaneous pneumothorax.

Annular shadows appear most frequently above the third rib and in the interlobar fissures but these are the locations at which autopsy shows lung rupture to be least frequent. Thus at the Phipps Institute, in only one out of fifteen cases in which rupture was found did the perforation occur between two lobes into the interlobar fissure. Landis[6] points out that rupture occurs most often "in the lateral portion of the upper lobe between the third and sixth ribs." Powell and Hartley[4] show that the perforation "is usually found in the upper half of the lung, though rarely higher than the third rib, since above this point the pleural cavity is generally obliterated by adhesions."

In none of the Loomis series was the development of an annular shadow accompanied by any symptoms characteristic of lung perforation and in no case did Sampson, Heise and Brown report such an incident. It may be conceivable, but it is extremely improbable that, in the single case mentioned, not to speak of others, there should occur a series of five lung ruptures without any typical symptoms. Further, none of the cases showed clinical evidence of sepsis that accompanies the inevitable infection of the pleura in a certain percentage of cases of spontaneous pneumothorax.

Clinical experience has shown that small pockets of air will be absorbed

by the pleura in the space of a few weeks. In contrast to this, it must be repeated and emphasized that annular shadows may persist for more than a year.

The authors cited assumed that a shifting fluid level connotes the presence of air also. This is not necessarily so. Sir Douglas Powell[7] showed more than fifty years ago that in pulmonary tuberculosis, due to various disturbances of anatomy and function, the pleural surfaces may not approximate everywhere as in the normal case, but there may be localized puckerings or retractions with actual separation of the pleural surfaces. The resulting interstices may be wholly or partly filled with a serous effusion that is later resorbed. On these grounds the presence of fluid in annular shadows may be explained.

The annular shadows reproduced experimentally by Sampson, Heise and Brown show outer borders more sharply defined than the inner borders, whereas pleural annular shadows seldom if ever show this but almost always the reverse relationship.

The Trudeau group argue that the prognosis is more grave because of lung rupture, but one may reason without fear of being criticized as illogical that the outlook is less favorable, not because of the presence of the annular shadow, but because the annular shadow accompanies tuberculosis that is active and progressive.

It is, of course, necessary to explain the mechanism of the formation of annular shadows and the hypothesis that has been suggested by the Loomis studies may be briefly outlined as follows:

From the underlying lung disease or other adjacent focus a single point on the pleural surface is infected and there results the usual inflammatory reaction. By direct extension the process advances peripherally, most often radially, equally or unequally, from the original center of inflammation. The extension may continue as disease progresses or cease as disease becomes quiescent. Viewed at any time during its course, the expected picture would be that of a localized pleurisy, the older process with or without adhesions lying at the center with the fresher products of inflammation — fibrin, cells and exudate — at the periphery. The roentgenogram to correspond would show a heavy circle, ovoid or other figure, as the case may be, representing this peripheral deposit of fresh inflammatory products while the comparatively clear area of the figure within the dense border would represent the older process where there is only a little residual fibrosis or pleural thickening. As yet there is no conclusive proof of the correctness of the hypothesis but simple experimental findings have tended to be confirmatory.

To support the conviction that most of these shadows represent localized pleurisies the following evidence is offered:

At the Phipps Institute,[8] pleurisies and pleural adhesions were found most often in the upper part of the chest in the interlobar fissures, next, posteriorly and least frequently, anteriorly. These observations have been abundantly confirmed. It is striking that pleural annular shadows locate themselves in exactly the same sequence of frequency.

All roentgenographic characteristics of annular shadows may be explained on this hypothesis. The most constant of these characteristics is the fact that the inner border is more sharply defined than the outer border, indicating that the fresher process is at the periphery.

All accompanying clinical symptoms may be explained on the basis of this hypothesis. The wave-like temperature curve, aching pains in the chest, malaise and inability to improve, without acute symptoms such as sharp pain, dyspnea, cyanosis, septic temperature and prostration, are all compatible with this assumption.

Finally, an artificial localized pleurisy may be constructed according to this hypothesis and radiographed, reproducing the most characteristic features of pleural shadows.

There has been no positive evidence presented to substantiate the theory that the shadows indicate in most cases perforation of the lung but there is considerable evidence that is nullifying. Affirmative evidence may be adduced to support the hypothesis that most annular shadows represent simple localized pleurisies and it is believed that sound reasoning cannot controvert it.

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DISCUSSION ON PAPER BY DR. AMBERSON

Member: May I ask the author of the paper whether any of these cases ever went to autopsy and if the findings were confirmed?

Dr. Maurice Fishberg, New York: When Dr. Brown and his co-workers some three years ago published their paper on annular shadows, I was intensely interested in the subject because at that time I had made a study of localized pneumothorax. Though I had noted these annular shadows on numerous plates that I had seen, I never thought that they invariably indicate localized pneumothorax. However, after reading Brown's work I began to look at it again and I came to the conclusion that in a large proportion of the cases Dr. Brown was correct.

I have done some work along other lines than medical. I believe there is some reason for structure usually and we can explain disease sometimes by facts derived from morphology. The lungs, as we well know, consist of lobes. There are three lobes in the right side and two in the left. There are inter-lobar fissures between these five lobes. These fissures have an object. If there was no fissure in the lungs, we would probably

have, when attacked by disease, tuberculosis in all the three on the right and in the two on the left side.

This inter-lobar fissure in the vast majority of cases, especially in those of a chronic nature, more particularly in those which are running a fibroid course, are thickened; the fissure, in most cases of tuberculosis, stops the progress of the disease down.

Those who base their opinion on roentgen findings have observed these things and realize why the inter-lobar fissure is very frequently thickened. We can very well conceive that if the process does not lead to adhesions there may occur a rupture at that place. But inasmuch as that inter-lobar fissure is in most cases glued together, you cannot expect a local pneumothorax.

Now and then it occurs and we recognize it clinically. In my ward at the Montefiore Hospital, radiography has been found of great assistance in recognizing it.

In many of these cases, as Dr. Brown has reported, and as I have observed in my own work, with a small localized pneumothorax there is an effusion which shifts. Consequently I am inclined to the belief that a large proportion, though not all of these cases are due to a localized inter-lobar pneumothorax which may or may not have been recognized.

Dr. Kennon Dunham, Cincinnati: I know of no subject which interests me more than this of annular shadow and localized pneumothorax. A study of stereoscopic chest plates has brought to our aid a great many things which we must learn to interpret. I do not see today how, from a purely x-ray standpoint, we are going to be able to do more than to theorize upon these annular shadows. I rise most of all to give a warning as to the danger of our seeing things and allowing a vivid imagination to run away with us in trying to interpret some of those things which we are seeing upon the x-ray plates. We have a great deal to study and a great deal to learn.

Coming to the annular shadows, they undoubtedly exist, and ever since the paper of Dr. Brown, we have all, I think, been trying to understand exactly what they mean and trying to interpret what it is that we are seeing. That article was a real contribution; the authors interpreted those densities as localized pneumothoraces. Today we are presented with another interpretation.

It would seem to me (I think over 25 of these localized pneumothoraces have now come to autopsy) that the majority of them are probably the result of cavity. There is a way of proving this; that is, definitely localizing these areas in the lungs, x-raying them, x-raying the lung after it comes out of the body to see that the location still remains as it did before and then cutting down at that point and seeing what we have. I want to say, just as has been explained to you, that there is thickened pleura around these areas, but underneath every one that we have cut down upon, we have found the cavity.

That will not, however, explain all of them. There is one other way you can prove it. You are not forced to wait for the patient to die.

Let us prove our findings. If you have a suspected pneumothorax, put in a little gas, cause a partial pneumothorax. In those where we have caused a partial pneumothorax, we found them due to cavity. If that was a pneumothorax and you put air in, it should disappear; if it is a thickened pleura, it should greatly change its shape. If it is a cavity, you will find that the surrounding circle increases in density as that lung is contracted down over the cavity.

I call your attention to the importance of considering cavities. Don't think this will solve our problem. It will not. If you have a circle of increased density, apparently lying within the lung, practically open, pointing toward the hilum and connected to the hilum with a heavy trunk, regardless of the x-ray picture within that density, you are dealing with a cavity. That is almost sure. There you can see on your plate this circle of density and the opening towards the hilum, and when you see that, it is wise to diagnose cavity.

On the other hand, we have diagnosed some very evident pneumothoraces at the apex and found that they were nothing but completely rimmed out cavities. Again we have had a couple of cases that looked exactly like cavity, and when we proceeded to watch it longer by x-ray plates, the history changed, there was a break, there was a great expectoration of fluid and there was no evidence left of cavity in a little while; undoubtedly a localized pneumothorax between the upper and lower lobes on the right side had emptied itself.

I want to call your attention to the fact that the position with regard to the first and third rib would be misleading, because when you speak of the third rib, I take it you mean the third rib in front. The whole lung lies on the bias and you have to consider that a great many of these areas lie below the third rib behind.

Then in going over it, let us think of one more point; — cavities, thickened pleura, pneumothorax, and one more thing and that is the thickening of the septa, that runs down from this thickened pleura into the lung, mapping off a piece of your lung very clearly and which will very closely simulate one of these annular shadows.

Dr. Lawrason Brown, Saranac Lake: I am very much interested in Dr. Amberson's thoughtful paper and I don't think there is any question but that he has proved his point in some of these cases. As I recall our paper I believe that we offered our idea as the most probable explanation of some of these phenomena.

I think some of his reasoning is not absolutely correct; for instance, when he says that the frequency of pneumothorax would controvert any such explanation as we have made. It is not perfectly logical. We know that pneumothorax occurs most frequently at the lower borders of the upper lobes, usually on the left side because the left fissure is lower than the right and that is the part of the lung that moves most frequently and where there is the greatest strain.

The reason, possibly, why these localized pneumothoraces do not become general pneumothoraces, which he implies they should become, is due to

the fact that they occur higher up, not at the points I have mentioned and consequently are not subjected to the same strain and therefore they remain localized. They occur in the part of the lung where pleurisy most frequently occurs, but they also occur in the inter-lobar fissures or at least at points in the lung picture (x-ray plate) where you could explain them as occurring in the inter-lobar fissures most frequently. The fluid level may also show movement.

Dr. Dunham: How much movement?

Dr. Brown: Considerable. We have proved it to our own satisfaction.

Dr. Dunham has brought up a question about these various explanations of annular shadows and I think you can accept most of them. Dr. Dunham has made the statement that in his opinion most of them are cavities in the lungs. It is very difficult to understand how cavities can change so greatly in size in such a short time, become very small and then completely disappear to recur later. I have never seen that happen with any real cavities in the lungs. Possibly it does; I would like to believe that the lungs could recover so well.

Dr. Fred H. Heise, Saranac Lake: I was very pleased to hear Dr. Amberson's paper for the simple reason that I am glad to see somebody else working on this problem. When we first worked out these pleuroannular shadows, I was convinced that all of them were localized pneumothoraces. Later on, by reason of an experiment on a guinea pig, I was convinced that some were not due to pneumothorax.

I am quite sure that Dr. Amberson is in part right; *i.e.*, that there are cases that give you this annular shadow in which there is no evidence of any pneumothorax or of cavitation. I have seen that demonstrated in an experiment on a guinea pig.

Only once in my experience an annular shadow was found to be localized pneumothorax at autopsy.

I have yet to see any fluid that will give a rapidly moving level in the lung in the total absence of air; it is impossible. You must have air present to produce a fluid level that will shake under the fluoroscope. Air must be there; it is a law of physics. You must have air to get your shaking fluid level.

In pleurisy with effusion in the early stage, you undoubtedly do get a moving dulness, but the movement of that fluid, compared to the movement of the fluid in these annular shadows, is so slow as to compare the traveling of a horse drawn vehicle to that of a 60 mile per hour automobile. You couldn't get the same movement to save your life.

I am thoroughly convinced that the vast majority of these things are localized pneumothoraces and that they occur in the fissures. My reasons for so believing were not in the least influenced by Dr. Amberson's logic about the occurrence of pneumothorax. The occurrence of pneumothorax in the general pleural cavity is an entirely different thing from a pneumothorax in the pleural inter-lobar space.

I would guess it to be not more than a twentieth of one per cent. of

these cases that rupture in the general cavity. The majority of them in the course of two weeks or a month or more disappear or recur. I have seen in pulmonary tuberculosis the absolute disappearance of all x-ray evidence of the disease when there was positive sputum, and I am willing to believe almost anything as far as the curability of pulmonary tuberculosis is concerned, but I am not yet ready to believe at the present time that cavities can perform such functions.

Dr. Dunham: All of them don't do that.

Dr. Heise: No, as you say. So I am still convinced that the majority of them are due to localized pneumothoraces.

We had a large number of lungs sent to us for radiographic purposes. We found in one of these lungs one peripheral circle of tuberculosis such as Dr. Amberson outlined, where rupture had occurred in the pleural space with an elevation of the pleura and a pneumothorax present. That was really what led us to the belief that these were localized pneumothoraces.

Dr. Dunham: What part of the lung, upper lobe or below the third rib?

Dr. Heise: In the fissure.

There is every reason in the world, when we consider the pathology of what might happen in these localized pneumothoraces, why they may be limited. What happens first? A tubercle on the periphery, in a space in which the two pleural surfaces lie one against the other. Naturally we get, as Dr. Amberson says, a localized pleurisy. There is a little escape of air. Our pleural thickening widens as the pressure of the air increases. It diminishes as the pressure of the air diminishes.

As to the activity of the disease, we all know that we have different definitions regarding this. If a patient is able to be on his feet, exercise an hour twice a day, maintain his health and freedom from symptoms, and still can be regarded as having active disease, then I will admit I have never seen a pleural annular shadow except in active disease; but if activity means that a patient cannot perform such things, then I will state I have seen these annular shadows in inactive cases. In other words, I have seen people who were able to be on their feet and exercise an hour twice a day without any symptoms whatever, in whose x-ray plates annular shadows were present. I have seen them present in people who were perfectly able to be up and about without any inconvenience to themselves regarding their symptoms — no cough or expectoration, no symptoms of any pleurisy, no pain, no shortness of breath, no rapid pulse, no temperature.

The Chairman: In justice to the rest of our long program, unless it is your wish to continue, I will call on Dr. Amberson to close the discussion.

Dr. Amberson: This has brought out some arguments which I really anticipated. I think, as Dr. Dunham says, all we can do now is to theorize. To accomplish anything we must theorize a bit. I may say that

we have not confirmed this hypothesis by autopsy. As far as I know, in the literature there are no autopsy reports one way or the other.

It would seem that if these shadows represent localized pneumothoraces that occur most frequently in the interlobar fissures, then at autopsy we should find lung perforations, but we do not find lung perforations; they are rare in this location.

Regarding activity I may say that we have seen these shadows developing in ambulant patients, as Dr. Heise has indicated; but the roentgenograms have in every case indicated a progression of the intrapulmonary disease.

I should like to correct Dr. Heise's statement that a shifting fluid level, according to the laws of physics, always means that air is present also. Fluid will shift just as well in the presence of a vacuum. If we have just a simple pleural separation, whether there is air present or not, and if the space is not entirely filled with fluid, the latter is bound to shift with change of posture.

In conclusion I want to say that while most of the men here seem to think that most of these shadows represent localized pneumothoraces, granting that a few may represent localized pleurisies, I believe and am willing to stand by that belief, that most of them represent localized pleurisies granting that a few may represent localized pneumothoraces.

THEORETICAL CONSIDERATIONS ON THE APPLICATION OF ULTRAVIOLET RADIATION TO TUBERCULOUS LARYNGITIS

By Edgar Mayer, M.D.

Saranac Lake, N. Y.

It is not with the intention of making any special claims for this mode of therapy that this paper is offered. A citation of thirty-five cases that I have been able thus far to treat would probably impress you favorably just as the results did me. However, we realize only too well the lack of criteria for determining which patients would and which would not heal spontaneously after a sufficient period of time had elapsed. Therefore adequate proof must necessarily be lacking. What should interest us much more is a consideration of the basic principles to decide whether or not we may rationally expect that ultraviolet irradiation of an accessible lesion, such as in the larynx, can promote healing. This necessarily involves a study of any direct effect of ultraviolet rays upon the body tissues.

Varying claims for reflected light radiations have been made. The majority of workers until recently have employed reflected sunlight. Kunwald, Blumenfeld, Sorgo, Jessen, Jansen, Malgat and Vevey abroad, Mills and Forster and others in America, have all been rather well impressed. Brüning and Albrecht were disappointed in their work with solar rays, while with x-ray radiations they were able to demonstrate some fibrosis. With ultraviolet exposures, Heusner, Ladebeck and Pachner have employed reflecting mirror devices and considered their results favorable. X-ray radiations of the larynx have also their exponents (Fleck, Ramdohr, Kümmell and others) some confining them to infiltrative processes, others to ulcerative lesions.

Because an accurate understanding of the rays employed is necessary, both when working with reflected sunlight and with reflected and direct ultraviolet radiations, it becomes essential for us to consider, at least briefly, the light sources and their qualities. Sunlight as it reaches us both in high altitudes and in the lowlands, contains the longer ultraviolet rays, as well as the visible heat, light and actinic rays and the invisible infra-red rays; the shorter ultraviolet rays are lacking. In altitudes, the ultraviolet intensity is greater, both in winter and summer, than in lowlands.

Reflectors made of special metals can eliminate the heat rays, and the ultraviolet reflection by their use may yet prove considerable. Nickel,

aluminum, silver, platinum, silicon and magnalium may all be employed. Of these metals, magnalium, an alloy of magnesium and aluminum, is the best reflector of the chemical rays and completely eliminates the heat wave lengths; an objection to it is the ease with which it corrodes. Silicon is difficult to obtain in a glazed form. Both of these have the best reflecting properties (85 per cent. of the ultraviolet wave-lengths are reflected). The other metals mentioned reflect 35 per cent. to 45 per cent. Mirrors of glass are less effective than those of quartz because of the marked absorption of the ultraviolet rays by the former. Quartz furthermore is less fragile, does not oxidize and can be easily sterilized by boiling because of its resistance to very high temperatures.

The mercury-quartz lights contain an abundance of the short ultraviolet rays, not present in sunlight, as well as the additional longer ultraviolet, blue and violet wave-lengths (all chemically active). Seventy per cent. of the radiation emitted by the mercury-vapor arc consists of ultraviolet rays. Very few heat rays are emitted except the infra-red wavelengths derived from the heating of the quartz-container itself and the metallic electrodes and the surrounding hood. It is interesting to note that after 1000 to 1500 hours intermittent usage about 50 per cent. of ultraviolet rays are still present. The total radiation after the same period decreases in intensity one-half to one-third the initial value. (Coblentz, Bureau of Standards.)

The reflecting mirrors employed in this series are made of quartz resting upon a nickel base. The surface is concave to obtain a greater intensity. Mirrors first tried out were of solid quartz surfaced with platinum. On comparing the intensity of chemical irradiation emitted, it was found that too much was lost to make the latter valuable. These reflectors are attached to the water-cooled mercury-quartz light. (Kromayer lamp.) Laryngeal reflecting mirrors can also be employed with the air-cooled lamp but the intensity of radiation is reduced too considerably to make it serviceable.

As far as was ascertainable, all workers thus far have employed reflected radiation, each aiming by some special means to obtain the greatest ultraviolet intensity. A direct source of radiation which the new lamp offers would seem more desirable. The lamp is a small mercury-quartz water-cooled apparatus, similar to the Kromayer lamp, which can be easily handled and is not too large for insertion into the mouth. The top is covered with silver-leaf, so as to prevent burning of the pharynx and to obtain added reflection. Applied to the skin, radiation from this source produces with a two minute exposure at a distance of two inches, a marked erythema. The lamp is curved to conform to the pharynx and can be placed close to the larynx. The frequency and duration of the exposures depend upon the reactions obtained. The proper dosage for ultraviolet exposures of any lesion has not yet been accurately determined and must still be based upon experience. Actinometers recently devised by Fürstenau and others consisting chiefly of selenium cells, have not proved their value. It has been shown by many

that with the x-ray, both for superficial and deep lesions, minute radiations can produce stimulation, while larger doses can easily destroy tissue. This would similarly seem to hold true for any form of light rays, the change occurring with only the smallest variation in dosage. We can provide either activation with small exposures or destruction with larger ones, a fact that has been demonstrated by Hess with the epithelial cells of the capsule of the lens, by Bovie with unicellular organisms, by Behring and Meyer with ferments, and by Lutz with cells of the epidermis. Hence it is obvious how necessary it becomes for us to develop some means of accurately dosing our radiations, a measure that is for the present lacking. Until then comparisons of results of different workers will be difficult.

What is known of the direct effect of light rays upon tissues? The heat rays (red and infra-red) set up an immediate vascular dilatation. This hyperemia interferes with the penetration of the ultraviolet ray, as Finsen has shown, but may nevertheless prove a factor in stimulating healing. The penetrating power of the heat ray is great.

The actinic rays (blue, violet and ultraviolet) produce chemical changes. The hyperemia set up by them occurs only after a latent period. Their irritating power may stimulate response on the part of an otherwise sluggish disease process. It is doubtful that these rays have a specific selective destructive action upon tuberculous tissue. They can, however, rapidly destroy tubercle bacilli, but this bactericidal effect plays a minor part, if any, in the healing of lupus, as Klingmüller and Halberstädt have shown. Finsen at first wrongly considered this the essential factor but his pupil Bang emphasized the hyperemic effects. It was Finsen who demonstrated that the chemical rays were those producing healing. Krüsius, with sunlight, was able to delay the development of experimental corneal tuberculosis in rabbits by exposure made immediately after inoculation and considered this due to the destruction of some of the inoculated bacilli. According to Browning, Russ, Bovie and Schunck, the bacteria are particularly affected by the shorter ultraviolets, those wave-lengths not present in the solar spectrum as it reaches us. The ultraviolet rays are most easily absorbed in the superficial layers of tissues and it is this marked absorption that brings about the chemical changes. This is the factor generally emphasized as very important for healing. The violet, indigo and the blue rays have a somewhat deeper penetration.

The tissue proteins are easily acted upon by the shorter ultraviolet rays, whereby albumins become globulins; the protein of tuberculin is easily changed; movements of collodial particles cease. Ferments are affected (Neuberg and Packard); peroxidases can be increased by small doses of the longer actinic rays, but destroyed by larger doses of the shorter ultraviolet wave-lengths (Behring and Meyer). Lymphocytes can be increased by local exposures of the shorter ultraviolets. (Janet Clark.)

Histological changes after ultraviolet exposures of tubercles of a rabbit's cornea (Jansen) show destructive effect, namely dilated vessels,

partial thrombosis and destruction of giant cells and epithelioid cells, followed by a serous and sero-fibrinous exudate with a collection of white blood-cells, and finally vacuolization and necrosis. In lupus, there were less blood-vessel changes because of lessened vascularity. Jansen could find these effects no deeper than one-half millimeter.

To increase the direct effectiveness of ultraviolet radiation upon tissues, fluorescent substances have been applied by me in isolated instances to the larynx. In this way, it was hoped that greater penetration of the shorter actinic rays could be brought about. The results were not encouraging. I attempted this with eosin application upon five patients but discontinued because of the lack of encouraging results. It might be better to apply quinine rather than eosin with ultraviolet wave-lengths, as the absorption spectrum of quinine is best for the ultraviolet rays. However, its disagreeable taste prevented me from using it.

Have we a right to expect unusually rapid healing in the application of an intense source of ultraviolet radiation to the larynx? Judging from the results obtained by Finsen with lupus of the skin, a superficial lesion to which direct pressure could be applied, it would not be probable. It generally required exposures of one hour every five days with the carbon arc over a period of six months or more to obtain healing in the lupus cases. With the reflectors employed in this series the patients have taken exposures by graduated increase up to forty-five minutes bi-weekly, the duration being decided by the reaction. The mucous membranes withstand radiation fairly well. With the direct source of light, exposures thus far have been increased only to ten minutes. Some patients occasionally did develop burns in the pharynx but they were never serious.

Many workers have tried to heal disease of the larynx with general exposures of the entire body to ultraviolet radiation. Blevgad, Malström, Strandberg and other Scandinavian workers claimed good results with the carbon arc. Jesionek maintained that by general exposures he could obtain focal reactions in the larynx but only in patients who had developed an intense skin pigmentation. Malström believed he obtained them with general exposures of the carbon arc. The effect of general radiation upon the body tissues is not firmly established, but we can conceive of an indirect effect upon a distant focus of disease by way of the blood stream. How this occurs must yet remain unexplained. Changes of colloids and cell membranes, increased oxidation and reduction, changed proteins of the tissue cells and blood serum, variations in the number of blood cells, destruction or activation of ferments have all either individually or collectively been held accountable. The good results with general radiation have not been realized by many workers other than the Scandinavians. It was tried upon ten of my selected patients but with slight encouragement.

Blumenfeld considers that the principal factor in the development of a tuberculous laryngitis at the commonest sites of infection, namely beneath the vocal cords and the mucosa of the posterior commissure, is

the retardation of the lymph stream in these regions. It is interesting to note further that some observers have claimed, on the basis of theory only, that ultraviolet radiation aids by stimulating lymphatic flow. Should these assumptions have stronger foundation, one might be justified in offering ultraviolet radiation as a prophylactic measure at the very onset when any sign whatsoever would make us suspect the larynx.

What evidence have we of the healing effect of direct ultraviolet radiation upon other superficial lesions? Cold abscesses gradually lose their suppuration and the clean wound is then stimulated to granulate. Fistulæ are more difficult to heal because of our inability to bring intense radiation to the very depths of the lesion. With non-tuberculous suppurating wounds, bacteria are quickly diminished but reports do not agree as to the stimulation of granulations. Suppurating otitis media, tuberculous in character, can lose its discharge under these direct ray applications. Tuberculous kerato-conjunctivitis heals similarly. (Passow and Lundsgaard.) Many other reports contradict these results, but here again the difficulty of accurate dosage and the variations in application compel us to reserve judgment.

Before closing, a few general remarks upon the cases treated by me may not be amiss. Evidences of a marked focal reaction occasionally were noted by a feeling of fulness and dryness of the larynx; also pain and burning. Erythema and swelling lasting about forty-eight hours were seen in a few cases. With one patient a sharp red line of demarcation on the vocal cords was present demonstrating the part that had been exposed and the part that had failed to be reached by the rays. One reaction occurred of marked intensity with slight edema of the glottis and inability to phonate and swallow which proved rather distressing for five days and then gradually subsided. Only afebrile cases were radiated, because the patients had to come to the office for exposures. There were no marked sudden changes, but most of those who took the radiations bi-weekly for over three months were bettered, and many of them had had a previous trial of silence treatment without result. Some ulcers healed but a few have not responded. Swellings were often diminished. Irritating cough disappeared at times. Three cases of dysphagia were relieved, but two did not respond without aid of drugs. No harm has been noted in any case.

CONCLUSIONS

1. Ultraviolet radiation heals superficial tuberculosis (lupus) but requires prolonged periods of time.

2. Important direct effects of ultraviolet radiation upon diseased tissues, namely destruction of superficial organisms, production of hyperemia with chemical changes of cell protoplasm and special influence upon the ferments, are known.

3. Theoretically one may justifiably expect that ultraviolet radiation, of sufficient intensity to produce focal reactions, can stimulate healing of tuberculous laryngitis.

4. Impressions thus far obtained by this form of treatment by direct application of the rays are encouraging.

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RESULTS IN ONE HUNDRED CASES OF PULMONARY AND INTESTINAL TUBERCULOSIS WITH THE USE OF THE ULTRA-VIOLET RAY

By Sidney F. Blanchet, M.D.

Saranac Lake, N. Y.

Historically, on the use of sunlight and the ultraviolet ray, I shall only speak briefly. In ancient times, first by the Egyptians and later by the Greeks and Romans, mention is made by various writers of the beneficial effects upon the bodily health of exposure to the sun's rays. The Romans used to have sunning places on the roofs of their houses and some dwellings had solariums. From that time occasional writers spoke of the value of sunlight and with the beginning of medical research some study was made of sunlight and its effects upon the body. However, it has only been in comparatively recent times that a serious study has been made of this subject; most of this work has been done within the last twenty-five years.

Finsen, in 1899, reported his work with the ultraviolet ray by means of an apparatus devised by himself. He applied it in some cases of lupus and also tried it on the skin lesions of smallpox. A little later, Bernhard reported the results he had had with the employment of sunlight in his surgical cases. About the same time in 1903, Rollier began to use sunlight in treating tuberculosis. The mercury vapor quartz lamp was perfected by Heræus. Kromayer, using a special form of this lamp, which was named after him, began his work in 1904. Since that time the number of workers who have made use of light, both natural and artificial, in the treatment of tuberculosis has constantly increased.

INTRODUCTION

The time allotted does not allow me to go very fully into my subject but I should like to make two things clear. First, that I began to use the quartz light therapy not only without enthusiasm but with a good deal of prejudice and yet was convinced fairly early by results that were secured with it. And, secondly, that these results have been obtained in a goodly number of cases of an uncertain or bad prognosis; indeed, the improvement in some cases has been so striking that I have become an enthusiastic advocate of light therapy.

We, workers in tuberculosis, are all of us eager to learn of any new measures that will aid us in our fight against this disease. We all have,

at all times, under our care a large percentage of patients for whom we feel that there is little prospect of recovery. The justly time-honored rest, fresh air and good food will probably continue to constitute the backbone of all our treatment; we have seen many patients recover through the use of these measures alone. Most of us have tried tuberculin therapy faithfully and have arrived at varying conclusions as to its value. Artificial pneumothorax has given brilliant results in many cases and is being employed more widely as time goes by. But sunlight therapy, while it has been faithfully employed by scattered groups of tuberculosis workers, has not been generally taken up.

Two reasons led me to make use of quartz light therapy: First, because valuable results had been reported by reliable men and, secondly, because upon becoming acquainted with the quartz lamp, I saw a means of employing light therapy in Saranac Lake where natural sunshine cannot be depended upon every day. A third reason might be added and perhaps for me it was the most compelling — I was very anxious to find some means of helping the numerous patients who fail to respond sufficiently to any of the above well tried measures.

When I began to use the quartz lamp, as I said above, prejudice and lack of enthusiasm hampered me in my work with it. I set the lamp up in my office and selected a few patients for treatment, which was administered to them two or three times a week. I was frank with them, saying that valuable results had been reported but that I could promise nothing. My doubts and prejudices made me slow to acknowledge results when they did begin to come. So that, although I began to use the quartz lamp as long ago as August, 1918, it was not until April, 1919, that the improvement shown by two or three patients convinced me that light therapy was valuable.

Once I became convinced that it had benefited two patients who were seriously ill, I began to push the treatment, setting up lamp after lamp in various boarding houses and nursing cottages where they became available to groups of from two or three to ten patients. All patients who used the lamp took daily light baths and I planned, especially as time went by, to give longer treatments and to bring the lamp gradually as close as possible in order to secure a maximum penetration. Beneficial results now began to come more frequently and some serious cases, such as those in which intestinal tuberculosis had developed, showed striking improvement. It is well to emphasize here that results were frequently slow in coming and that a number of patients apparently failed to give results that could be definitely credited to the lamp. But the improvement shown by many patients was so unquestionably consequent on the employment of this measure, that all my prejudices vanished. Let me say here, to those who question or doubt these results, that until they have given it a faithful trial in a representative group of cases, they are unjust in their criticism or condemnation of this method of treatment. Not only this, but they are depriving some invalids of a chance of recovery that they otherwise will not have.

RESULTS

It takes time and patient effort to secure results with this method of treatment and many patients fail to receive the benefit that others strikingly show. But this same thing is true of tuberculin therapy and is also true where artificial pneumothorax is employed. As in the use of artificial pneumothorax, light therapy is usually employed in cases of more or less advanced tuberculosis or in those of an unfavorable type where the prognosis without the use of these measures is bad. Also, as in the use of artificial pneumothorax, one will be able with experience to select or to recognize the type of case that is most likely to respond to light therapy.

From my observations in the 100 cases I am reporting, the beneficial action of the treatment is not easy to analyze. It seems to me that the effect is largely due to the action of the ultraviolet ray upon the skin. We know the importance of the skin as a bodily organ, the part it plays in the maintenance of normal body temperature, and the excretory function of its pores. We have all observed the condition of the skin in patients suffering with tuberculosis, especially its condition when they are feverish and weak. The skin at this time is usually toneless, moist and clammy. The muscles underlying it are wasted and limp and there is very little subcutaneous fat. This individual is not only weak from illness but his skin and muscles are weak and toneless from inactivity. His circulation is never invigorated by normal bodily exercise. His body and skin are usually, especially in winter, more or less smothered by clothing; the air and light rarely reach them. The pores of this skin are inactive also and their inactivity helps to increase the load the sick body has to carry.

Perhaps the most striking improvement noted with the use of the quartz lamp is the invigoration of the skin, it becomes quite a different organ. A skin invigorated by light therapy is no longer sick; it becomes live and healthy and as the patient improves and gains weight, his whole appearance changes. It is easy to understand how this invigoration of the skin and skin circulation, this stimulating of the pores to carry off body waste, will improve the condition of the patient. In a good percentage of cases the temperature gradually drops to normal and consequent on this, appetite, digestion, weight and strength slowly improve.

Deeper effects of the light treatment are very difficult to prove. Experiment has shown that apparently it only penetrates a short distance into the skin. However, it is possible that the blood in the superficial vessels may absorb and carry something deeper. The results secured may be all due to the effect of the ultraviolet ray on the skin but it does seem in some cases that the penetration is deeper. It is difficult to explain the improvement in intestinal cases without allowing that the light produces some deeper effect.

It has seemed to me that the benefit derived from the light treatment could be well compared to the effect of sunshine upon a plant that has

made a gallant effort to grow in a dark corner. Our patient's bodies are, especially in winter, thickly covered with clothing so that little air or light reaches them. The effect of exposing their bodies to light and air might be compared to that upon the plant which is brought from its dark corner into the sunlight.

But it matters not how it acts if it is beneficial. If in light therapy, we have a means of helping a patient to control the activity of his disease so that he gradually recovers his health, we are securing the results aimed at and accomplishing a great deal.

The 100 cases treated with ultraviolet ray that I am reporting seemed to fall easily into the following two groups,—*group one* was made up of active cases, in which are included those of recent development, threatening progressive development and a group of older cases which had become more or less stationary but were beginning to fail, showing fever, loss of weight etc.; and *group two*, in which are collected cases of old standing which had improved up to a certain point but apparently could go no further.

Included also in these two groups are cases in which intestinal tuberculosis had developed and also a number of cases in which artificial pneumothorax had been used. Progressive improvement failed to appear in either of these groups until light therapy was instituted.

To go into detail, there were 50 cases in group one and 50 cases in group two.

Of the 50 cases in group one, treated from three months up to one year or longer, 13 showed excellent improvement; in all, temperature became normal, weight and strength improved and an apparent arrest of the disease has been secured. Another 14 of these 50 cases showed some degree of improvement, that is gained enough to justify perseverance in the use of this measure; 10 cases remained about the same, 8 continued to fail and 5 died. That is, over one half definitely responded to quartz light therapy in some degree.

The 50 cases in group one were all of a bad prognosis, some of them more or less acute progressive cases and yet in a period of over a year only 5 have died. Of the 5 who died, 1 death followed uncontrollable hemorrhage (this patient had been using the lamp for six months), 1 followed spontaneous pneumothorax (this was a patient with acute progressive tuberculosis in which artificial pneumothorax had been used); another death was in a case where this treatment was employed following a resection of the bowel, and the remaining 2, which were cases of far advanced tuberculosis when the treatment was begun, failed and died. In fact, the cases which gave no response, those that continued to fail and those that died, were all more or less far advanced or unfavorable.

The 50 cases making up group two, all fairly quiescent but at a standstill, responded in the following way. I might say also that all these patients had been ill and under the usual treatment for from one to two years or more. Of these, 15 responded well, that is appetite and di-

gestion improved and weight, strength and general condition became more normal; they took a new interest in life and began to look forward to the possibility of recovery. Fifteen more of this group showed some response, enough to encourage persistence in the treatment. The remaining 20 have showed little change as yet; 5 of them have showed signs of failing. There have been no deaths in this group.

That is, in the second group of 50, 30, or over one half, have shown a varying degree of improvement.

Summarizing the figures of the total 100 cases, 28 showed good continued improvement, 29 showed some gains, 25 cases remained unchanged, 13 showed signs of failure and 5 died.

I wish I had time to report in detail a few cases in which the results were truly remarkable, but my time is almost up and I must only say a few words in conclusion.

The results secured in patients in whom intestinal tuberculosis had developed are the most remarkable and deserve especial mention. There were 25 of the 100 cases in which intestinal disease showed clinically and in which intestinal irritability was demonstrated by the x-ray. Of these 25, 10 have lost all symptoms and now show a negative picture with the x-ray; they are in good general condition and have been fever free for some time. Five more are making some improvement, another 6 are failing and 4 have died. The relief experienced by patients with intestinal tuberculosis who respond to the light treatment is alone an argument for its trial in all cases where intestinal disease develops.

In my experience with light therapy, there have been no ill effects from its use in cases subject to hemoptysis. When hemoptysis occurs, I omit the treatment while the patient is bleeding but take it up again as soon as the bleeding is stopped.

Various nervous effects are described by patients; some are stimulated by the treatment and others feel soothed and relaxed after a light bath. A number of patients complain of itching but this is usually only in the early days of the treatment. Insomnia is complained of by a few. In some cases there are psychic effects.

Menstrual pain is relieved at times; in some cases the relief experienced is quite remarkable. This relief may be accompained by more profuse menstrual flow.

It is difficult to be sure of the difference in the response of blonds and brunettes; in my series both responded well, but perhaps the brunettes a little better.

The results obtained in cases in which artificial pneumothorax had been employed without being followed by continued improvement are also worthy of special mention. In 5 of my cases who had been taking this treatment for from six months to a year, the benefit following the use of the light was quite remarkable.

In cases where pulmonary disease alone was demonstrable, the effect of the treatment has been less striking. Improvement in temperature, appetite, digestion, weight and strength were observed. Cough and ex-

pectoration sometimes increased for a time but the cough was usually easy and productive. On the other hand, cough and expectoration sometimes diminished from the start. The improvement in the physical signs in the lungs was of course very much as observed in any patient who improves.

Many individual cases would be of great interest if there were time to go into detail but I shall have to bring my paper to a close, as my time is up. However, in closing, I should like to repeat that the results I am reporting are the conclusions arrived at after over two years of careful work. I hope that my paper will lead to the adoption or trial of this measure by other men. It is rather tedious work, but when results begin to come one feels amply repaid. In my 13 years of practice, I have worked faithfully with the regulation rest and hygenic treatment and have seen many patients recover their health in this way. Tuberculin in my experience has seemed to be of benefit to some patients. I have treated personally over two hundred patients with artificial pneumothorax and believe it is of great value in well selected cases. But I have always had many patients who responded to none of these measures and it has been to this type of case that I have seen the quartz lamp treatment prove beneficial. It has been a great comfort to me to find this measure of value. If my report of results obtained encourages any of you to use it or to persist in its use, I shall feel more than gratified.

DISCUSSION ON PAPERS BY DR. MAYER AND DR. BLANCHET

Dr. A. M. Forster, Colorado Springs: I would like to call attention to some of the practical advantages of the use of the instrument that Dr. Mayer has shown, as well as the one that I use, leaving out, of course, any discussion of the theory of the thing as discussed by Dr. Mayer, because I don't feel that that part of the work is thoroughly worked out as yet.

I think the chief advantage of these instruments is in calling attention to the necessity for some treatment of laryngeal tuberculosis. That treatment may not necessarily be local, and some of the laryngologists are now of the opinion that local treatment may be overdone. The most important point, however, in the treatment of laryngeal tuberculosis, as in the treatment of tuberculosis elsewhere (but possibly more emphasized in this particular side of the question) is that of discipline, and certainly anything that gives a ray of hope to the man who has the most serious of all tuberculosis complications is going to be a help from that point of view.

Of course I feel that with the solaroscope, a very distinct advantage is obtained, in that you let the patient see his own lesion. I know a distinguished member of this Association who keeps a pair of tuberculous lungs in a jar in order to show them to his patients, because we cannot get the patient to visualize a lesion which he does not see and often does not

feel directly. I think it is a very distinct advantage to the patient to be able to see his own lesion, not only because he realizes that the situation is as the doctor describes it, but also because he can watch any favorable or unfavorable change in that larynx. It is even more an advantage to the doctor himself. While we realize by the observance of symptoms in pulmonary tuberculosis and by the method of physical diagnosis, that constant changes for the better or worse are going on in the lung; these changes we can see so clearly from day to day in the larynx and see in such detail, that it is of great help.

In the case of the solaroscope, I feel that the control the patient gets of his pharynx and larynx — all his muscles — is a very important thing. In order to apply treatment, he has to learn to control these muscles and to control them very thoroughly. I have often seen what seemed to me rough treatment on the part of laryngoloists in the handling of such a delicate organ as the larynx, due largely to the fact that the patient had no control over his throat. It is unquestionably true that in the course of a week or two weeks and sometimes longer, depending upon the ability of the patient to get this control, he will secure absolute control of his pharynx and all his muscles and will permit you not only to look in and give a very careful and thorough examination, but also to apply your treatment in the gentlest and most favorable manner.

I would like to ask Dr. Mayer if he has noticed what seems to us one point of considerable importance. That is the relief of pain. Certainly there is a series of cases of laryngeal tuberculosis in which nothing is going to do any good, yet we have found that with the use of the light rays we can get a distinct relief of pain, at least to the point of avoiding too constant overwhelming use of some drug in order to allow the patient to swallow.

I am disappointed that Dr. Mayer says he has not been able to use his treatment on the bad cases, because I hoped, when I learned that Dr. Mayer was developing this quartz lamp in the treatment of laryngeal tuberculosis, that he would be able to touch those cases that sometimes we cannot reach, those who are desperately ill so that they cannot come to a place convenient for giving sunlight or cannot be placed in a proper position for it, and still who might get advantage of this anodyne effect of which I have spoken.

Dr. Gerald B. Webb, Colorado Springs: I would like to take this opportunity to put a case on record here, for two reasons. The first is that in Colorado we have a great abundance of sunshine which, as your essayist says, is not so abundant in Saranac. The second is that this is an infant eight months old with plastic tuberculous peritonitis, which was almost hopeless. This baby was sent out by Dr. Curry of New York. There was definite proof of bovine infection.

We had that child under heliotherapy for six months without any benefit to a mass on the abdomen six inches across and three inches wide. When I say there was no benefit I mean that the child had gained no weight and we did not feel very much encouraged about curing her. We

then changed to the use of the quartz lamp, the alpine lamp. Within a very short time we began to notice a very great improvement in this infant. Its weight was increased, the mass began to disappear and after eight months' use of the quartz lamp, the mass had practically entirely disappeared, and Dr. Curry now tells me in New York that if he had not known the mass had been there, he could not be sure that there was ever anything the matter.

So I think it is worthy of record to contribute that experience at this meeting in connection with the discussion which has been so well brought out by Dr. Blanchet and Dr. Mayer.

In our cases we have not yet had quite such good results as our essayists have reported.

Dr. Charles L. Minor, Asheville, N. C.: I have been very much impressed by this discussion. I feel that in the testing out of a new method like this it is extremely important that it be given a fair trial, and I hope that those men who have patients in hospitals under control will set up a series of comparative cases. Take five cases without and five cases with and treat them comparatively.

I have treated some patients and some have done very well, but we must have a large series of cases. I trust that some of you who do control large hospitals will try the lamp out faithfully. It will be difficult, for commercialism may very easily, in view of the cost of the apparatus, force itself into this thing, and that we want to avoid, but if this treatment offers these poor intestinal cases for whom we can do so little, some opportunity, then we must give it a fair trial. However, to come here and report ten cases, twenty cases or even one hundred cases does not get us anywhere for it does not begin to settle the question we are all so interested in.

Dr. C. D. Parfitt, Gravenhurst, Ont.: We welcome this advance in the treatment of laryngeal tuberculosis as described by Dr. Mayer in the use of the quartz lamp, the artificial rays. The paper is a supplement to Dr. Forster's paper on the use of reflected sunlight, which was presented before this section three years ago. While we are forced to believe from their results that these methods are very effective, I fear we may be led to delay the use of an effective and comparatively cheap and simple method of treatment of the larynx which unfortunately is not used more freely. I refer to the galvano-cautery. It has so simplified the treatment of laryngeal tuberculosis that its occasional use in any but the fulminating cases makes laryngeal tuberculosis much less a menace today than it was some years ago before this instrument came into general use. It is not difficult to learn to use and it is so effective that I should like in this discussion to draw attention to the method and how useful it may be for tuberculous laryngitis in sanatorium and private practice.

Dr. E. S. Mariette, Hopkins, Minn.: I would like to ask Dr. Blanchet one question about his technique. Does he advocate a gradual increase in the area exposed after the method of Rollier, or does he advocate general radiation at once or only locally over the abdomen?

Dr. Lawrason Brown, Saranac Lake: I have been very much

interested in these two papers because I have seen some of the cases and I think both of the speakers have been very modest in their claims, particularly Dr. Blanchet. I have asked Dr. Mayer before what proof he had that the local treatment by the ultra-violet ray did anything more than the general treatment, for we know that there have been some cases reported where the patient was treated generally, and, though the diseased skin areas were protected from any direct effect of the ultra-violet ray, they healed under the general radiation. That led me to believe that possibly the larynx might heal just as well under general radiation as under direct application. Furthermore, we know that the cases which show possibly as much change, as much benefit from the use of this treatment as others, are the intestinal cases, and inasmuch as the ultra-violet rays, as far as we know, penetrate but one-fiftieth of an inch, we know that no local application of the ultra-violet ray is ever made directly to the intestinal wall, and yet there is a very marked and sometimes a very rapid change.

I was interested, of course, in the treatment of intestinal tuberculosis largely because we were not getting the results from surgical treatment that I hoped we would get. Out of some 16 cases that I had operated on, 13 died. Of course a number of them were the cases first operated upon and not now considered suitable, and these figures that I am giving you are not really to be taken too seriously. Of the controls that I had I think about 50 per cent. died. Sometime ago when I looked up the cases of intestinal tuberculosis, only five out of thirty cases that I had treated with the lamp (though they were more recent cases) had died, and it seemed to me that something connected with this treatment had helped considerably. I am not prepared to say definitely that it was all due to the ultra-violet ray; it may be due possibly to the exposure of the skin to the air. We are trying to solve that point, if we can, by the use of reflectors with high-powered bulbs to see whether cases treated in this way would do just as well as the others treated by the lamp.

Dr. Forster: I think that I was the first of the men in the Association to take up the use of the quartz lamp, and passed through all the enthusiasm that Dr. Brown exhibits in regard to what Dr. Minor calls his abdominal interest in this question. I think that we ought not to confine our consideration to one particular phase of the subject. I think that, possibly because of what Dr. Brown says, all the benefit we get from this treatment is the general effect, and we certainly ought to try it out and use it most faithfully.

Of course we have the feeling that in tuberculosis expressing itself in surface lesions, we do get a distinct benefit, sufficiently more than that of the internal lesions to make us feel that the light has some local effect. The reason for using the lamp in Colorado is not the lack of sunshine, but for avoiding whatever harmful effect we get from the heat rays. We have come gradually to realize that we can use sunlight even where we have temperature, and yet we still recognize that the heat rays of the sunlight have a very marked effect and that our use of sunlight in active temperature cases must be very guarded and very careful.

Consequently these quartz lights which, to a large extent do not have heat rays, offer us an opportunity to start much earlier and push our treatment much more rapidly than we do when using sunlight. Yet I cannot help feeling that the heliotherapy with the natural light that the Almighty made possibly has some advantages over these man-made machines.

I think that the group at Saranac have done tremendously much to stimulate the use of heliotherapy and since these gentlemen have taken it up, I have noticed a very widespread increase in the interest in regard to it.

I would like to add a word about what Dr. Parfitt said. I am very glad that he brought out that point and I for one want to say very positively that I don't think that this light treatment should take the place for a moment of any of the older and well recognized forms of treatment of tuberculous laryngitis, and certainly, as Dr. Parfitt said, the electro-cautery in selected cases and carefully done by one who knows the work, is a most important item in the treatment of that condition.

Dr. John H. Pryor, Buffalo: At Perrysburg, an institution in which I have been very much interested, we have now treated 675 cases of so-called surgical tuberculosis. Of that number 125 have been tuberculous peritonitis and thus far only one case of that nature has failed to recover without surgical aid. In this instance an operation became necessary for a deep abscess.

The intestinal form of tuberculosis is a different proposition and in those cases very often there must be a resort to surgery, in spite of all the attempts at sun treatment; but we can prepare the case and get it ready for operation if necessary, and we claim that the sun treatment should precede, if possible, the surgery.

In regard to the ultra-violet lamp, we have used seven of them for years. We have practically come to believe that its effects are largely psychic. It does not take the place of the sun. We use the Rollier treatment and we depend upon the chocolate brown color of the whole body for its effect upon the local trouble, no matter where it is.

We now use, combined with the sun treatment, the French lens. It may interest you to know that that is now made by Bosch & Lomb and we are employing eight with some modifications we have introduced. Where the bone tuberculosis has healed and the x-ray shows that the bone has been replaced by new formation but the ulcer or the sinus persists and will not heal as rapidly as we desire in spite of the sun treatment, we then use the French lens directly upon the sinus opening. Thus we bring about a reaction and a more rapid recovery.

In regard to cases of the larynx we have seen no results that we can say positively are due to the ultra-violet lamp. We have, I think, obtained results from thorough Rollier sun treatment and the application of the sun direct to the larynx.

In regard to the amount of sun, we can't send the poor patients to Colorado or Arizona where there is more sunlight. Consequently we use all the sun that we can obtain and we have found out one interesting fact

and that is that there are two sides to the question of locality: while you may have the sun in Arizona a great many days in the year, we have found that there are times on a hot summer day when we have to be extremely careful in the use of the sun treatment and we have learned further that the sun in cold weather makes for quicker results.

I remember one time when we had three weeks with practically no sun. An opportunity was offered to study very carefully the results during that time. There is no question that the patients did not recover as rapidly, but on the other hand they retrograded. At such times we depended upon the air bath and upon the ultra-violet ray, but the ultra-violet ray did not give us the same result. Then would come a period of sunlight and we would see a remarkable change in the patients when we could apply it thoroughly. The point to emphasize is that the vast majority of cases of surgical tuberculosis are among the poor and we must treat them as near home as we can. The chief requisite is to have some one employed whose whole duty is to use the sun every minute it makes its appearance.

The Chairman: Unless it is wished to continue this discussion further we will now conclude it. Dr. Mayer.

Dr. Mayer: In answer to Dr. Forster's question about the use of these lights for bed cases, I am showing you this apparatus which was devised in the hope that it could be used with the ordinary alpine lamp by the patient himself in his home, because nowadays many of the patients have these lamps in their own homes; in fact in Saranac Lake the boarding-house keepers have them. I really hesitate to show you this because it appears so elaborate and it is a question whether it is feasible. It has a laryngeal mirror reflector, of platinum surface, held by a mouth gag, and attached to this is a small mirror so the patient can see how he applies the light to the larynx.

It is difficult to compare sunlight with the radiation from these lamps as the spectrum of each is entirely different. The red rays are for the most part absent from the lamps. There is very little danger from the use of ultra-violet rays but there is danger in pulmonary cases if one employs sunlight without guidance. Bacmeister cited three cases where patients fully clothed over-exposed themselves to sunlight for a few hours (falling asleep in the sun) and following this high fever and other symptoms developed, showing acute progression of the disease, whereas these cases up to then were old, fibrous, quiescent lesions. The effect in these cases was considered as due probably to that which was not present in the alpine lamps, namely, to the heat end of the spectrum.

The air-bath of which Dr. Pryor spoke is probably an important factor in the use of sunlight and is possibly more important than the ultra-violet ray itself although this is not proved. At Perrysburg in the winter time when the ultra-violet content of the lowlands is comparatively small the results are also particularly good so that there are many factors to be considered.

Dr. Forster asked about the relief of pain. I have three cases, two of which responded and one did not.

As to Dr. Parfitt's question, the electro-cautery has been advised and employed by a number of Scandinavian doctors in conjunction with ultra-violet radiation. Especially in ulcerating lesions have they employed electro-cautery first and then followed it up with general radiation and they claim excellent results. As to the local exposures, thus far they were able to employ only reflected light which may not have the proper intensity to set up a focal reaction and if intense radiation is what is required then possibly the lamp I have shown may help us. I hesitate to offer such elaborate apparatus because the use of it is still in an experimental stage but I did consider that I was rather modest in the claims made.

In reference to Dr. Webb's case his patient was indeed unique considering the age of the child. However, in older patients with peritonitis many workers have reported quite as remarkable results with ultra-violet radiation and similarly with pyosalpinx. Fromme has reported about eight cases in which masses about the size of a fist previously palpable, quickly disappeared after a course of exposures to ultra-violet rays so that the masses could no longer be felt.

In answer to whether a local application is needed, it is true that Jesionek was able to destroy lupus by covering the diseased area and exposing the rest of the body but this occurred only when the patient developed a strong pigment. It was carried out more for experimental purposes than to be employed as the procedure of choice. Jesionek himself treats these cases with added local radiation besides his general exposures and we know that Finsen treated his lupus only by the local method. We must also admit that if we can attain an added or quicker or possibly better result by local exposure it is certainly worth while to strive for it.

The question of how light can affect a lesion situated deep in the body is not settled. There are four possible theories that may be offered. First, there is the theory of a deep penetration of the ultra-violet rays which has been offered by a few workers who have tried it upon animals. The proof was not convincing, so that this is mostly discredited. Secondly, the theory is offered that fluorescent bodies which are present in the blood stream, namely, urea, hematoporphyrin and the iron salts, as well as bile which is present in the intestinal tract, may change these short ultra-violets to longer and more penetrating ones and thus allow an effect upon the deep tissues. Thirdly, there is the theory offered of absorption of so-called radiant energy (the exact significance of which is mostly speculation) or the action of the chemical energy that is liberated from the short rays as they are absorbed in the superficial tissues. Fourthly, the theory that reflexly, irritation of superficial nerve endings with ultra-violet radiation may affect the depths, has been mentioned by some and Henri tried to demonstrate this on the cyclops with which he was able to produce fatigue after severing the nerves from the spinal system and then setting up a reflex irritation from the outside. Up to the present we must still rely upon theoretical explanations.

Dr. Blanchet: It is very gratifying to me to have aroused so much discussion on the subject presented in my paper.

To answer Dr. Mariette's question, I have not followed Rollier's method. It has been my practice to expose the body in four parts, increasing the time at first and later bringing the lamp closer to the body of the patient. I have come to expose the body in four parts because as the lamp is brought closer, a more even exposure is secured by not trying to cover the entire body at one time.

Dr. Minor's question in regard to controls, I shall answer by saying that I have had controls in most of my cases. In the same house patients of a similar type, using and not using this treatment have "cured" side by side and the better progress of the patient taking light treatment has been frequently quite convincing.

Dr. Brown's remarks about the striking results being in cases which had developed intestinal disease are in my experience quite true. These patients are obviously more prostrated with their disease and the relief given to them is more remarkable. But in unfavorable cases where pulmonary disease alone was demonstrable, I have seen results come that I could not have secured in any other way.

As to Dr. Pryor's statement that "in his experience the quartz lamp has proved of no value," that "its effect has been largely psychic," I shall only say that there is a psychic element in all treatments that we use,—whether it is tuberculin or artificial pneumothorax or the doctor's influence alone. If the results that I have seen follow the use of the quartz lamp are all psychic, I shall from now on have a good deal of faith in the theories of Mary Baker Eddy.

A COMPARISON OF VITAL CAPACITY READINGS AND X-RAY FINDINGS IN PULMONARY TUBERCULOSIS*

By J. A. Myers, M.D.

Minneapolis

The lung capacity test was described just three quarters of a century ago. In fact it was used in the diagnosis of pulmonary tuberculosis at that time. For several decades following its first description, however, the practical application of the test was apparently not recognized and it was only an occasional scientific investigator who made use of it. In the last decade or so there has developed a tendency toward the revival of the lung capacity test and it has become a part of routine physical examinations in many places.

In the development of a new test or the revival of an old one there is usually one group of individuals who become too enthusiastic and make exorbitant claims for it while another group of individuals minimize and discredit its value at every opportunity.

The object of this work is to make a careful comparison of the vital capacity readings with the nature and extent of tuberculous lesions revealed by the x-ray in an attempt to ascertain the true value of the lung capacity test in pulmonary tuberculosis.

The observations here presented were made on approximately 100 men and women. Stereoscopic x-ray plates were made of the chest in every case and in order to secure uniform interpretations all plates were read by the same roentgenologists.

The water spirometer, made according to the specifications of Peabody and Wentworth, was used exclusively in measuring the lung capacity.

The patients were grouped as follows: 1.— Suspected cases who were proved to be negative. 2. — Cases of peribronchial tuberculosis. 3. — Cases of parenchymatous tuberculosis. Inasmuch as women have a lower lung capacity than men the cases were arranged first according to sex and second according to the extent of the disease as revealed by the stereoscopic plates.

The first group consists of 12 persons (6 men and 6 women) who came in for examination either because of definite exposure, rapid loss of weight, slightly streaked sputum or a previous diagnosis of active pulmonary tuberculosis.

The six women in this group, with one exception, had an observed

* From the department of Medicine, University of Minnesota.

vital capacity somewhat lower than the theoretical vital capacity. It has been pointed out that the coefficient of variation in normal individuals is in the neighborhood of 12 per cent. Therefore an individual's lung capacity may be 10-12 per cent. below the theoretical normal capacity and still be within normal limits. If the capacity is 15 per cent. reduced the case is on the borderline, while if the reduction is much beyond 15 per cent. there is some definite cause which is usually disease. It must be clearly understood, however, that not every case with a lung capacity reduced more than 15 per cent. is due to disease. For example, one of the women in this series has a lung capacity reduced 17 per cent. This case has been under observation for several months and repeated stereoscopic plates have revealed no evidence of pathology. The only basis on which to explain the reduced capacity is that of overweight. This patient is 15 per cent. overweight and this is a factor which, as Hutchinson pointed out, materially reduces the vital capacity of an individual. Hutchinson and others have stated that after the age of 35 or 40 years there is a gradual reduction of the lung capacity. One occasionally examines a case with a reduced lung capacity and is unable to find any basis for explaining the reduction.

The six men in group one had lung capacities within normal limits. Stereoscopic plates of the chest showed no evidence of lesion in any of the other 12 cases in the first group.

The second group consists of 20 cases (10 men and 10 women) whose stereoscopic plates revealed evidence of peribronchial tuberculosis. There was one woman who had a lung capacity reduced 18 per cent. The remainder of the women in this group had vital capacities well within normal limits.

With two or three exceptions the men in group two also had lung capacities well within normal limits. The patient whose stereoscopic plates showed the least peribronchial tuberculosis of the entire series had a lung capacity 26 per cent. below normal. The stereoscopic plates also revealed marked emphysema of the basal lobe of each lung which probably played a considerable rôle in the reduction of his lung capacity. The second case is that of a Philippino post-graduate student whose lung capacity was reduced 18 per cent. This patient gave a history of having had a chronic disease (not tuberculosis) in childhood which materially interfered with his subsequent development. Although this patient is now 31 years of age he weighs only 88 pounds. Inasmuch as the stereoscopic plates revealed only slight unilateral peribronchial tuberculosis with no other evidence of lesion it seems probable that the patient never developed a normal lung capacity.

In this group of 20 cases of peribronchial tuberculosis the lung capacity was no more affected when the disease was bilateral that when it was limited to one side.

From this small series of cases it appears that peribronchial tuberculosis affects the lung capacity very slightly or not at all. Therefore stereoscopic plates are necessary for its detection.

The third group consists of 69 patients (37 women and 32 men). In most of the cases of unilaterial parenchymatous tuberculosis in women the lung capacity is so reduced as to indicate disease; however, in four of these cases it was within normal limits. It was interesting to note that in one case with a very small lesion in the first interspace the vital capacity was reduced to 64 per cent. while the next case with slightly more extensive disease had a lung capacity of 104 per cent. Other similar cases in this series suggest that the lung capacity test is a more reliable index as to the severity of a lesion than is the x-ray plate.

In the series of women with bilaterial parenchymatous tuberculosis only two had lung capacities within normal limits. The remainder were reduced, having from 81 to 26 per cent. of the normal capacity.

There were 10 of the 32 men with parenchymatous tuberculosis who showed lung capacities within normal limits. Some of these apparently normal cases showed old fibrous and calcified tuberculosis, others have had the disease arrested for a period of years, a few had overdeveloped lung capacities through past physical training, while in one or two cases no explanation for the apparently normal capacity has been accepted. One patient had a lung capacity of 103 per cent. This reading was indeed misleading as the patient had cardinal symptoms of tuberculosis, the physical examination revealed minimal disease and the stereoscopic plates showed a definite gross tuberculosis extending to the fourth rib on the left side. Fortunately a lung capacity reading was taken in the Department of Physical Education of the University of Minnesota by Dr. L. J. Cook about one year ago, at which time the capacity was 580 cubic centimeters more than at the present time. This case brings out the following two important points: 1. — Through past physical training and experience an individual may have developed a lung capacity much above the normal and after the appearance of disease the capacity may be considerably reduced and still appear to be within normal limits. 2. — Lung capacity readings are most reliable when an individual's normal capacity has been established by actual observation at some previous time when that individual was in good health.

The remaining 22 cases in the series of men with parenchymatous tuberculosis showed reduced lung capacities ranging from slightly below the normal lower limits to 41 per cent. of the normal.

In several of the cases of parenchymatous tuberculosis more than one reading has been taken. These subsequent readings have been found of great value in ascertaining changes in the patient's condition before such changes were manifested through the physical examination or the x-ray findings. It therefore appears that one of the most valuable services of the spirometer is in following the course of disease after the diagnosis has been made. This instrument registers an increase in capacity from time to time as the disease comes under control. On the other hand a decrease is registered in those cases that become progressively worse. For this particular work the spirometer is of more serv-

ice than the x-ray and the readings are more easily and more cheaply obtained.

CONCLUSIONS

To draw any sweeping or final conclusions from observations on such a small number of cases is hazardous. However, the following conclusions appear to be justified.

1. In cases suspected of having pulmonary tuberculosis the lung capacity test is very valuable in aiding in diagnosis. If there is a reduction of more than 15 per cent. it is usually of clinical significance; however, other pulmonary and cardiac diseases may cause such a decrease. The spirometer is not sufficient in itself but stereoscopic plates are usually necessary. Often further tests and examinations must be employed.

2. There may be a considerable individual variation in normal lung capacity due to such factors as occupation, mode of living, past physical training and development. Therefore spirometer readings are most valuable in an individual whose normal capacity has been established by actual observation when that individual was in good health. Otherwise the reading might appear normal or even above normal and still be reduced several hundred cubic centimeters. In all questionable cases x-ray plates are indispensible.

3. In cases of peribronchial tuberculosis x-ray plates are usually necessary in diagnosis since in many such cases the lung capacity is well within normal limits.

4. In parenchymatous tuberculosis the lung capacity test is valuable in ascertaining the severity of the lesion when other factors, such as bronchiectasis, pneumonia and cardiac disease are excluded. It is not so valuable in ascertaining the extent of the disease since in a case with a very small severe lesion the lung capacity was reduced more than in another case with a low grade extensive lesion. Therefore the x-ray plates are more valuable in outlining the extent of the disease.

5. In some cases of fairly extensive fibrous and calcified tuberculosis the lung capacity is within normal limits. However, in most cases it is sufficiently reduced to indicate impairment of function.

6. The spirometer measures the ability and power of the lungs to function while the x-ray records the character and extent of the disease. Therefore each has a different part to play. Neither one is infallible but both are valuable.

NOTE: The Hennepin County Tuberculosis Association of Minneapolis made this work possible by establishing and supporting a research fellowship in the University of Minnesota. I wish, therefore, to express my indebtedness to this Association.

A considerable part of this work was done in the Glen Lake Sanatorium and I desire to express my thanks and appreciation to Dr. E. S. Mariette, Superintendent and Medical Director; Dr. F. L. Jennings, Associate Medical Director, and Dr. H. T. Boquist for their valuable aid and splendid coöperation.

I am also deeply indebted to Dr. R. G. Allison and Dr. R. E. Morse for the interpretation of the stereoscopic plates.

DISCUSSION ON PAPER BY DR. MYERS

Dr. Edward O. Otis, Boston: I would like to ask Dr. Myers a question or two. He referred several times to normal. What does he take the normal lung capacity to be? And how did he obtain it? Secondly, I would like to ask him if he has any difficulty in obtaining what he thinks is the normal lung capacity of whatever patient he is making the test upon?

Some years ago I took the lung capacity of 1,000 individuals who were presumably well, from 16 years of age up to 40. I averaged them and obtained the general average of 240 cubic inches (5,000 c.c.) The difficulty I find is that many persons perfectly well do not know how to perform the test, even after a great deal of instruction, so that it seems to me there is a source of error.

Again I would like to ask Dr. Myers if there is any danger in having a supposedly tuberculous individual take this test? Of course with the disease there is a diminution of the lung capacity, and moreover, I have not infrequently found a diminution of lung capacity in well individuals owing to the difficulty of having the patient properly perform the test.

Dr. Fred H. Heise, Saranac Lake: Dr. Brown and I have been very much interested in the determination of the vital capacity and the physical fitness according to Dryer's work and we have performed this test on a series of 75 cases, the results of 65 of which I have at hand.

Our method of procedure was to strip the patient and weigh him in kilograms; then to measure the circumference of his chest, measure the length of his trunk according to Dryer's directions and determine from these (from the weight and length of the trunk) the vital capacity of the man.

We did all of our work on men. The vital capacity, according to the length of the trunk and the circumference of the chest, based on a supposed weight for these measurements was also figured. We worked them out for three classes: class A, class B, and class C, as directed by Dryer in his book. Then after thoroughly questioning the patient we decided in which class he belonged according to the amount of physical exertion the man was accustomed to perform. Class A was very light physical exertion; class B moderate, and class C severe. The directions for the computation of these classes are given in Dryer's book.

As I say, we computed what the vital capacity should be for these men with a certain trunk length and a certain circumference of chest. Then we compared the actual vital capacity that we obtained from a water spirometer. Unless our methods were faulty, we were unable to get a reduction of vital capacity in more than about 35 of the cases that showed parenchymatous lesions in the lung. The majority of our cases gave us a range of minus or plus ten per cent.

It did seem to us, however, upon comparison of the extent of the lesion and of the occurrence of tubercle bacilli in the sputum, that these had some bearing upon the vital capacity.

These figures were worked out on 65 cases. We are in no way ready

at the present time to say much about this except to say that we were unable to get a reduction of vital capacity in more than about 35 per cent. of these men On the other hand, a list of the cases on whom we were doing these tests was sent to the x-ray man with a request that he estimate the vital capacity from the looks of the plates, and it was perfectly remarkable, that without any knowledge of the person upon whom he was making this estimate, his estimate practically came within ten per cent. of the actual vital capacity as determined for the individual according to his physical measure.

Dr. E. S. Mariette, Hopkins, Minn.: I want to report one case, which is, of course, no criterion. The vital capacity work was started at Glen Lake Sanatorium a little over a year ago, and the first 65 cases classified according to physical examination and vital capacity estimation checked up exactly, with one exception. According to physical examination this man was ready for work, but his vital capacity was very much lower than one would expect from a patient in his physical condition. In a short time he suffered a relapse with pleurisy with effusion, and in spite of all we could do empyema followed, and he is now in very much poorer shape than he was then.

I think that the vital capacity estimation will prove to be of great help in estimating a man's physical fitness.

Dr. Myers: The theoretical normal lung capacity was taken from Dryer's table in which the calculations were made from the trunk length and chest circumference. From this normal lung capacity and the observed lung capacity the physical fitness percentage was computed. In many cases, however, the percentage seemed high for the extent of involvement revealed by the stereosopic plates. Therefore other methods were used as follows: The normal body weight of each individual was ascertained from the weight table of the Prudential Life Insurance Company. Using this weight the theoretical lung capacity was computed from the formula

$$\frac{\text{Wt.}^{0.72}}{0.69} = \text{V. C. for men} \qquad \frac{\text{Wt.}^{0.72}}{0.85} = \text{for women}$$

In the last method the surface area of the patient was divided into the observed lung capacity. This gave the number of liters of air exhaled per square meter of body surface. From this number and the known normal the percentage was easily calculated. The percentages obtained from the three methods were averaged and the mean percentage was allowed to represent the physical fitness of the patient. It is interesting to note that the percentages obtained from Dryer's tables were usually somewhat higher than those obtained by the two other methods.

The difficulty in obtaining the vital capacity is occasionally experienced. It may take as long as 15 to 20 minutes to train the patient; however, in most cases one gets the maximum lung capacity in a much shorter time.

Three to five readings are taken in each case and the highest one is recorded.

I have taken vital capacity readings on some 250 tuberculous individuals and have observed no harmful effect on any patient. Other observers have reported that their patients received no injury from the lung capacity test.

CURATIVE VALUE OF PNEUMOTHORAX IN NON-TUBERCULOUS LESIONS OF THE LUNG—DISAPPEARANCE OF OSTEO-ARTHROPATHY

By William Charles White, M.D.

Pittsburgh

For the past few years we have seen an increased number of non-tuberculous abscesses of the lung. Among the important factors in furnishing this increase in numbers is undoubtedly the frequency of operations on the tonsils under ether and also other operations about the mouth, especially extraction of the teeth. Undoubtedly during the etherization and in the recovery from ether, aspiration of infected material occurs.

Secondary infections from these abscesses are frequent, especially in the joints and in the heart and kidney. These cases frequently have bloody sputum simulating tuberculosis and are often diagnosed as tuberculosis and sent to the clinic for this disease and also to special climates for curative purposes.

During the last year we have seen five cases (only two of which we are reporting) of abscess of the lung and in reporting them the point which I especially wish to bring to your attention is the very rapid recovery after collapsing of the infected lung by artificial pneumothorax. (Pneumothorax given by Dr. C. Howard Marcy of the Tuberculosis League.)

The most severe case, following tonsillectomy had intense osteo-arthropathy of fingers, toes and similar infection of ankle and knee joints with bloody sputum daily over many weeks.

The most important feature of the cure was the disappearance of these joint changes along with the collapse of the abscess and the complete dissapearance of the Hippocratic swelling.

The second case is the report of a woman who has been well and married and has given birth to one child. Re-expansion of her lung has taken place without the slightest recurrence of her symptoms.

I will include a synopsis of these cases with two charts, one prepared by the patient himself, and leave the matter before you.

Case 1.

Mr. J. H., age 36 years, American, white, occupation sales engineer.
Admitted to the Tuberculosis League Hospital on April 12, 1920.

Chief Complaint:

Swollen and tender joints, persistent cough with blood-streaked sputum.

Present Illness:

Patient was in good health until October, 1919, when he had a severe attack of tonsilitis. Two weeks later he began to raise small quantities of blood-streaked sputum and noticed a stiffness and soreness of his ankle and knee joints. Symptoms became progressively worse and on February 15, 1920, his tonsils were removed. No benefit was noted following tonsillectomy, but instead, new joints became involved, the cough and sputum increased and patient noticed a beginning enlargement of the ends of his fingers and toes. The symptoms gradually became so severe

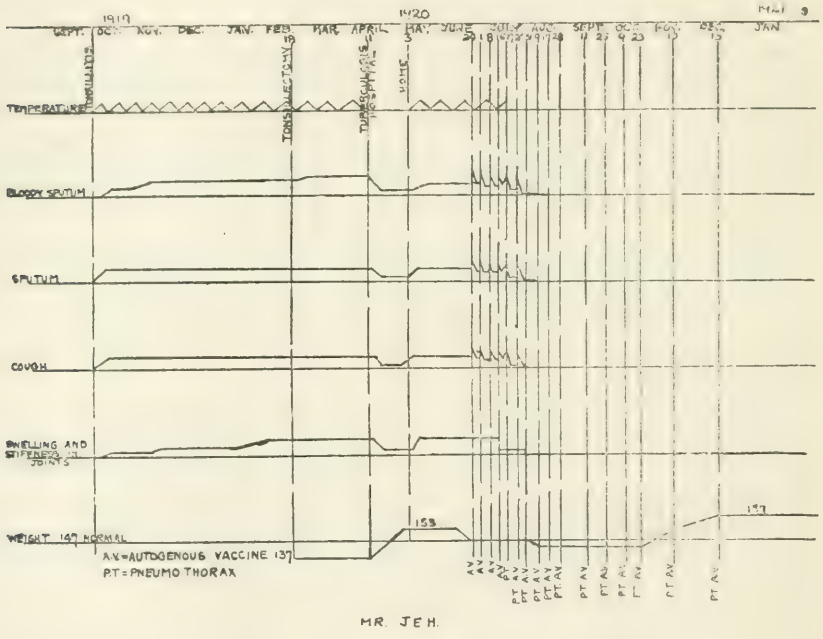

CHART I

that at time of patient's admission to the hospital he could move only with great pain and difficulty.

Past history negative except for attack of influenza in 1918.

Family history negative.

Physical Examination:

Patient on admission to the hospital was a well-developed, fairly well-nourished adult male. Chest normal shape with fair expansion. Resonance over the second and third right intercostal spaces was very slightly impaired. Breath sounds and whispered voice sounds here were somewhat increased. No râles were heard. The heart was normal. Fingers showed marked clubbing. There was considerable swelling and tender-

ness with some increase in surface temperature of the ankle, knee, and wrist joints. Other physical findings were negative.

X-ray Examination:

Stereoscopic plates showed a pear-shaped opacity about 1½ inches in diameter occupying the center of the second right intercostal space anterior. Other features of the plates were uninteresting.

Laboratory Findings:

Sputum— 12 cubic centimeters in twenty-four hours. Sputum purulent and blood tinged. No tubercle bacilli were present. Bacteriological examination gave a pure culture of pneumococcus.

Blood culture negative.

Blood Wassermann negative.

Haemoglobin, 80 per cent.

Red blood cells, 4,500,000.

White blood cells, 11,000.

Diagnosis:

Abscess of right lung.

Polyarthritis.

Treatment:

Autogenous vaccine made from organism recovered from sputum.

Artificial pneumothorax with results as shown on the accompanying chart.

Case 2.

Miss E. S., age 21, American, white, occupation stenographer.

Admitted to the Tuberculosis League Hospital on February 24, 1917.

Chief Complaint:

Persistent cough with large quantities of heavy, yellow, foul-smelling sputum.

Pulmonary hemorrhage.

Present Illness:

Onset in August, 1915, following the extraction of an infected tooth under ether anesthesia. Five days later developed sharp, shooting pains in the right chest associated with cough and fever. The acute attack subsided in about two weeks, but the cough with a low grade irregular fever, persisted. In July, 1916, she again had acute pain in the right lateral chest and at this time began raising large quantities of foul-smelling sputum. The average amount as stated by the patient was about one-half pint in twenty-four hours. Following a moderate pulmonary hemorrhage in February, 1917, she was admitted to the Tuberculosis League Hospital.

Past history, except for several attacks of tonsilitis, was negative.

Family history was negative.

Physical Examination:

Patient on admission to the hospital was a well-developed, fairly well-nourished adult female. Chest was normal shape with excursion of the right lung somewhat limited at the base. Resonance over the middle and right lower lobe was slightly impaired. Breath sounds and whispered voice sounds over this area were decreased. Scattered moist râles were present in the right lower lobe posterior. Otherwise the physical findwere negative.

X-ray Report:

Fluoroscopic examination showed a fairly dense shadow about the size of a silver dollar located in the right lung beneath the fourth and fifth rib

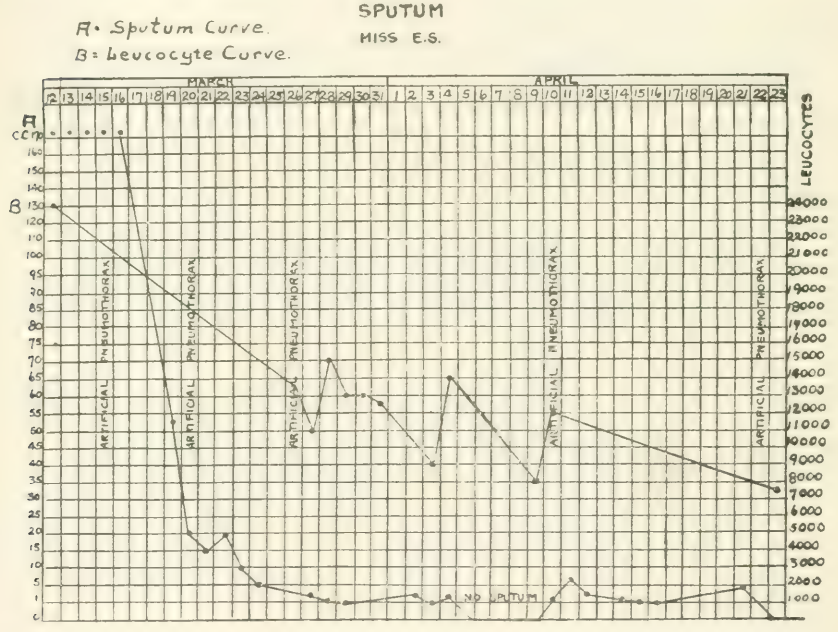

CHART 2

anterior, halfway between the midclavicular and midsternal line. Below this the lung tissue was obscured by a shadow of moderate density extending over the entire base. The diaphragm appeared to be free but motion on the right side was somewhat restricted. Posterior view corresponded with anterior and showed the shadow which was seen from the front. The heart and mediastinal contents were normal. Stereoscopic plates confirmed the fluoroscopic findings. No evidence of foreign body was seen.

Bronchoscopic examination showed pus coming from the right lower lobe.

Temperature ranged from 97 in the morning to 99² in the afternoon. Average pulse rate with patient in bed was 94 per minute.

Laboratory Findings:

Sputum — 175 cubic centimeters of thick, yellow, purulent, foul-smelling material in twenty-four hours.

Tubercle bacilli negative.

Urine — negative.

Blood — Culture negative.

Haemoglobin 80 per cent.

Red blood cells, 4,040,000.

White blood cells, 24,800.

Diagnosis:

Abscess of right lung.

Treatment:

Artificial pneumothorax with results as shown on the accompanying chart.

In conclusion I wish to bring especially before you that most exceeding care should be practiced in anesthesia given for infected conditions about the mouth, and to point out in similar cases where no adhesion and no infection of pleura is present, that with care we have with artificial pneumothorax an almost magic curative agent, which should be tried at least in these cases before grosser surgical procedures are used.

DISCUSSION ON PAPER BY DR. WHITE

Dr. Alfred Meyer, New York: I agree with Dr. White that sometimes the results of artificial pneumothorax in these embolic pulmonary abscesses are strikingly valuable. Which cases are going to illustrate that phase of therapy, I think it is almost impossible to say in advance, either from a physical examination or from the inspection of the x-ray plate. I insist that before deciding what to do you should at least have the coöperation of these two methods.

Sometimes the failure will depend upon so slight a thing as the direction and extent of one single pleural adhesion. I have known under such circumstances that a pneumothorax only partially induced, rather than tending to a cure of the pulmonary abscess really tended to increase the stagnation in that abscess, and this unfortunate result could not be predicted by a combination of the two preliminary methods of examination. However, I agree with Dr. White that the number of cases of pulmonary abscesses, mainly after tonsillectomies, has been on the increase in a way that is a real arraignment of a considerable number of our colleagues. Dr. Manges reported in the medical press some years ago a large number collected from one institution alone and it was suspected that the embolic abscesses were due to the fact that the operator did not use any suction apparatus. The fight is going on still among laryngologists as to whether

that explanation is true or not, because some think that these abscesses are not of inhalation but of embolic origin.

A number of men have been able to perform rather wonderful things with irrigation of the cavities. Dr. Lynch of this city and Dr. Yankauer are two men whose names occur to me just now, who have illustrated the value of irrigation of the abscess cavities, by means of the bronchoscope, and that same method of treatment also applies to other chronic cavities.

However, as proving what I stated in the beginning that once in a while an adhesion placed between the upper air passages and the site of the abscess will prevent the good result of a pneumothorax, I have the evidence of Dr. Yankauer that he saw that the pneumothorax had caused an increased kinking of the bronchial tube along the plane of the adhesion and he was unable to enter the bronchus and therefore unable to irrigate the abscess cavity.

What third method is there if pneumothorax is of no service and the bronchial irrigation of no service? Two surgeons in this city have developed the method of lobectomy. I hesitate a long time at the present stage of pulmonary surgery to recommend having a lobectomy made without saying to the patient, "You will probably die on the table." I know there have been a number of deaths on the table or shortly after. On the other hand if the patient threatens suicide unless something is done for him, the surgeon is compelled to operate and I know there are a number of cases in the city of New York which have been cured of their pulmonary abscesses by partial or total lobectomy.

Dr. Maurice Fishberg, New York: I have been very much interested to hear from Dr. White about this matter. Last month I saw three such cases.

I have tried three or four times to help these patients but have failed in many for the following reason: If you see many cases you will find that there are a large proportion where an effusion develops within one or two weeks after the abscess has been diagnosed. A case I had three weeks ago in Brooklyn is exceedingly interesting. A young man developed pain and a cough eight days after the operation. There was a copious pulmonary hemorrhage continuing for about four or five days. He finally got an effusion. The effusion compressed the lung, stopping the hemorrhage and he is doing fairly well.

As regards the treatment, if you get a case like Dr. White's, and can get into the pleural space and produce a pneumothorax, you may have good results, but in about two-thirds of the cases you will fail.

About a dozen cases of mine have been treated by irrigation through a bronchoscope without successful results. Any surgeon will tell you that you cannot irrigate an abscess about eight or ten inches deep and then expect it to collapse and heal; it can't do it. In many cases if you put the patient on the side on which he coughs most you will bring out most of the sputum; put him with his head down. It is a difficult thing occasionally to find which position will favor draining, but careful inquiry, if you have a coöperating, intelligent patient, may help you along.

As regards surgical treatment, every surgeon has one or two successful examples that he has cured, but the vast majority of cases have died, either on the table or within a few days after the operation. I personally do not recommend it any more if I can help it.

Dr. Edward O. Otis, Boston: There is hope that the artificial pneumothorax may be successful. I think Dr. Burgesson of Washington has reported cases which were early recognized, cases occurring after tonsillectomy, which were cured by the use of artificial pneumothorax.

My experience has been that when they have become chronic, artificial pneumothorax has failed on account of the adhesions. Surgeons will drain them and for a while they appear to be doing well. Then there is a recurrence and the surgeon hesitates to do anything more. These cases go on from bad to worse until they finally die a miserable death.

If the cases could be discovered early, as I have said, and artificial pneumothorax then applied, it seems to me that would be the most hopeful outlook.

Major Nathan Barlow, New Haven: In New Haven we have had 15 or 20 of these cases. I can say that the fact that a man has tuberculosis does not prevent an abscess from developing, so that if you find an abscess it does not prove that the patient may not have tuberculosis as well.

We have tried artificial pneumothorax in a number of these cases. All of the cases in which we have been able to induce it have done well and many of them have completely cleared up. I say "many", that is two or three, which is a considerable percentage, because we have only been able to induce even partial pneumothorax in about five or six cases. The rest of them have had adhesions already formed so that we were unable to enter the thorax, and we treated them by postural drainage and by every other approved method that we could think of, and none of them did what we would call well. A few of them died. The others lost their acute symptoms, but were left with chronic bronchiectatic conditions that became foul with every slight cold, and never recovered what we would consider as full health.

Considering the conditions in which the patients are left by expectant treatment, and in view of the danger of early formation of adhesions, it would seem to us that as quickly as pulmonary abscess can be diagnosed, artificial pneumothorax should be immediately induced so that the best results may be obtained.

Member: Have any of these cases been allowed to re-expand?

Dr. White: One case re-expanded and the woman to whom I referred, who had been married and had children, has also re-expanded with no recurrence.

CERTAIN MANIFESTATIONS OF HYPERTROPHIC OSTEO-ARTHROPATHY IN PULMONARY TUBERCULOSIS: A SURVEY OF A SANATORIUM GROUP OF PATIENTS

By H. J. Corper, M.D., and Philip Cosman, M.D.

in collaboration with

William M. Gilmore, M.D., and Louisa T. Black, M.D.

Denver

Tuberculosis is known to produce certain associated pathological alterations which are manifested in a variety of ways besides producing the essential primary pathological changes of the disease. These secondary changes appear to become more pronounced as the disease progresses and seem to be somewhat related to the duration or activity of the actual primary tuberculous disease condition. On account of the chronicity of tuberculosis the form of the actual gross appearances of these concomitant conditions is at times of a variegated nature. Of these associated concomitant conditions there has been probably more attention paid to the clubbing of the fingers, Pierre Marie's syndrome of *pulmonary hypertrophic osteo-arthropathy* or *secondary osteo-arthropathy*. The coincident clubbing of the toes, though studied, has been given far less consideration. Likewise, and especially in consumptives, the finger and toe nails have been given little consideration. It is not the purpose of this paper to dwell in detail upon the fundamental histological basis of these tissue changes as observed in tuberculous individuals, a field that pertains more to the realm of the skin specialist, but merely to report the results of a survey of the hands and feet, and oral and facial regions of a group of tuberculosis sanatorium patients with a view to bringing out some heretofore neglected, or only slightly emphasized and possibly new facts of interest to the tuberculosis and sanatorium physicians.

The literature on clubbed fingers and "secondary osteo-arthropathy" is replete with reports of individual cases, is so voluminous and has been so well summarized by other authors of recent years that only the more important points brought out by these studies will be touched upon here. In an interesting summary on pathological conditions of the nails, S. Parkes Weber[1] states that

Incurved nails in wasting diseases need not be associated with clubbing of the finger-tips, but clubbing of the finger-tips is always associated with more or less incurving or aduncation (hooking) of the nails. The condition is frequently, but by no means always, accompanied by clubbing of the toes; but in such cases the clubbing in the toes is generally less marked than in the fingers. The causes of the clubbing are still not completely understood, but toxic conditions connected with suppuration, etc., and chronic venous congestion and cyanosis (local or general), play important parts in the pathogeny. . . . A somewhat acute development of clubbed fingers is occasionally observed in pulmonary and other intrathoracic diseases associated with suppuration, such as bronchiectasis, empyema and pulmonary abscess, which need not be accompanied by a considerable cyanosis. . . . The condition may certainly disappear almost as readily as it arises when it is connected with some curable suppurative condition in the thorax. Occasionally clubbing may develop even within a single week when it is accompanied by pain, while at times no cause could be found for the occurrence of the clubbing.

White[2] in a clinical study of 485 cases of nail disease collected at the Massachusetts General Hospital extending over a period of three years found that eczema with 107 cases produces the most frequent examples of nail disease, trauma or felon (72 cases) being second, paronychia (68 cases) third, psoriasis (67 cases) fourth, and professional dermatitis without paronychia (62 cases) fifth; syphilis formed only 5 per cent. of his cases. There were only two cases of tuberculosis verrucosa (vertical ridge, discoloration, separation from bed and broken nail) and only one of pulmonary tuberculosis (with increased convexity) revealing nail disease.

In 1890 Piérre Marie[3] first described the skeletal disease characterized by a thickening of the long bones in the vicinity of the joints, with a peculiar clubbing of the finger ends, under the title of "De l' Osteo-arthropathic Hypertrophiante Pneumique" as differentiated from acromegaly. Because of the secondary relation of the disease to some pulmonary affection he appended the adjective "pneumique". Independently and almost simultaneously (1889 and 1891) Bamberger[4] reported a series of similar cases and called attention to the presence of hippocratic fingers in individuals with bronchiectasis without tuberculosis. Since these original papers on this condition numerous reports have been published more definitely establishing this morbid condition as a distinct clinical entity among the general group of allied diseases, including leontiasis ossae, osteitis deformans, acromegaly, rickets, syphilis of the bones, etc. In a most excellent review and contribution to the study of this subject Locke[5] of Boston in 1915 added considerable information to our then rather scattered knowledge of this condition. He states that

The evidence is overwhelming that hypertrophic osteo-arthropathy is always a secondary disease. Among the primary diseases, pulmonary tuberculosis is probably the most important though rarely inducing the extreme degree of bone and joint changes seen with bronchiectasis. There is a very definite correspondence between the characteristic clinical course of the disease and the process in the

bones. During the periods of exacerbation in the primary disease, the pain, tenderness and swelling in the soft parts are not only increased, but the process in the bones is also more active. On the other hand during the quiescent periods associated with cure or relief of the condition responsible for the bone and joint changes, the process in the bones is stationary and in rare instances actual resorption takes place. The new subperiosteal bone, which is at first sharply marked off from the old shaft, later becomes (usually after a period of some years) a more compact, dense layer, closely fused with the underlying old bone. In the late stages of the most progressive type of cases there is evidence of widespread halisteresis in the affected long bones. Occasionally the process in the bones and joints once established may progress even after actual cure of the primary disease. The ungual phalanges as a rule show proliferative changes. They consist mainly in an irregular burr-like expansion of the distal half. More rarely small osteophytes are found at the proximal ends near the line of the joint cartilage. The epiphyses of the affected long bones are to some extent always involved, but the new osseous tissue is much more irregular in outline and the ossification is less complete. The proliferation in the long bones in advanced cases is more general than has been recognized, often affecting nearly the entire skeleton. Changes in the joints are a constant and important feature of the disease. While the early changes are confined largely to the periarticular tissues, in the later stages, erosion of the cartilage, lipping about the joint, and even a moderate degree of ankylosis are common lesions.

A considerable percentage of cases of so-called hippocratic fingers show by means of skiagrams early proliferative changes in the periosteum of some of the long bones of the forearms and lower legs of exactly the same type as seen in hypertrophic oste-arthropathy. Simple clubbing of the fingers and secondary hypertrophic osteo-arthropathy should be considered as identical, the former representing an early stage of the latter.

Leo Kessel[6] of New York in 1917 made an exclusive study of hypertrophic osteo-arthropathy in 32 cases of pulmonary tuberculosis of the second or third stage of the disease. Roentgen examinations were made of the hands, feet, all of the long bones, the bones of the pelvis and in some instances the shoulder girdle and cranial bones. Following the classification of Locke the 32 patients were divided into three groups: (1) 5 patients presenting simple well defined clubbing of the fingers without bone changes (3 of these had extensive pulmonary cavitation); (2) 17 patients showing clubbing of the fingers with bone changes in the phalanges; and (3) 10 patients with clubbed fingers and changes in the long bones (six of these presented the globular nose formation and malar thickening). With the exception of the awkward appearance of the lower arms and legs of three of the patients in group 3, these patients disclosed nothing in their physical examination to differentiate them from patients in the other two groups, yet the Roentgen-ray examination revealed decided differences.

Kessel was unable to establish any relation between the clinical manifestations of the pulmonary disease and the type of the osteo-arthropathy present. Pronounced evidence of pulmonary tuberculosis may be associated with simple clubbing of the fingers, while less marked manifestations of the pulmonary disease may be accompanied by distinct changes

in the long bones. The bone changes, moreover, are not definitely associated with the type or degree of the clinical expression of the pulmonary disease. No deviation from the normal nitrogen and calcium metabolism was obtained in these cases. Kessel concludes as a result of his studies that the degree of clubbing corresponds only in a general way to the radiographic findings; bone changes occur more commonly than is ordinarily supposed in the so-called simple clubbed fingers; pronounced changes in the long bones may take place without any clinical sign or symptoms being present; the type of bone change in the various groups is the same, the difference being rather in degree; hypertrophic osteoarthropathy is present more frequently in pulmonary tuberculosis than the usual clinical examination would permit us to believe.

Montgomery,[7] in a contribution on the deep transverse furrowing of the finger nails following local asphyxia, believes the blue or violet discoloration of this condition is due to a local excess of carbon dioxide in the blood and this occasions the peculiar deformity of the nails with transverse furrowing. The deformity usually arising long after the condition, a pneumonia for instance, that gave rise to it. He states that

> The nail grows from a slot, which is formed by a fold of the integument. In order to comprehend the relationship of the nail to the general integument, it is necessary to regard the skin as one great gland, faced by a horny covering, secreted or elaborated by itself from its own epithelial cells. Out of invaginations in this vast surface there grow modifications of this horny covering; out of invaginations that are holes, hairs grow; out of invaginations that are slots, nails spring. At the bottom of the nail slot there is no papilla as there is at the bottom of the hair hole or follicle, nor is there one needed. The hair has to grow out a long distance as a free floating cylinder, and therefore, must have a rich supply of nutriment at its base, to be transmitted up its medulla or richly cellular center. The nail, on the contrary, is a short, flat plate with very little free projecting edge. It is produced back in the previously mentioned slot, and is slid forward on longitudinal grooves in the nail bed, to which it is tightly adherent, and from which it receives nourishment and undoubtedly also some addition to its under surface. Very little nail substance, however, is produced distal to the lunular surface. Any injury received by the nail when it is in the formative stage, deep in the slot, may deform it, and this deformity is gradually slid forward with the natural growth of the nail, and does not become visible until the nail plate is free from the posterior nail fold. It takes six months for the nail to grow out (which coincides with Heller's estimate of the rate of growth of the nail, about 0.1 mm. a day). In addition to the interest attaching to such deformities as indicating the time when the malady that produced them occurred, they also may give some idea of the severity of this malady.

He believes that it also gives some idea of the tenesmic convulsion of the tissues by their effort to expel the carbon dioxide and probably also the accompanying lactic and other acids that should be carried away by the blood as formed. The process may be a tenesmus of the muscular walls of the blood vessels, comparable to the tenesmus in the muscular walls of the intestine or bladder when these viscera become over full of

expellable contents. The basis for his conception is that given by Yandell Henderson in which it appears that carbon dioxide is the normal stimulant that supports the circulation, respiration, intestinal tonus and contraction.

Herbert French[8] in 1917 expressed the opinion that whereas longitudinal (lateral) ridges on nails generally mean nothing in particular, transverse ridges on nails (especially symmetrical) are important evidence of a previous disease, the time and duration of which can be approximated by the transverse ridging. Ball and Alamartine[9] in 1912 expressed the opinion that hypertrophic osteo-arthropathy is occasioned by toxins or poisons developed as a result of pulmonary tuberculosis which like the urates in gout have a specific predilection for certain tissues and locations, the changes in hypertrophic osteo-arthropathy occuring in spite of the total absence of the tubercle bacilli in these tissues. They describe the condition in dogs similar to that in man and with like etiology.[10] The investigations to be reported were initiated with the primary object of studying the nails of the feet of consumptives with a view to determining how many could be benefited by treatment, it having been observed previously that a fairly high percentage of sanatorium patients complained of nail trouble, especially ingrown nails. Upon closer investigation this proved to be in the majority of cases occasioned by the variously called "hippocratic nail" or "parrot beak nail" or inverted nail of different authors, associated with hypertrophic osteo-arthropathy. As a result of our studies we prefer to call this the *hyperconvex nail of hypertrophic osteo-arthropathy*, a more appropriate and descriptive term for the condition.

It was soon realized, however, that if the study was confined merely to the nails a number of important points valuable in considering treatment might easily be overlooked. It was, therefore, decided to elaborate and study the hands and feet of a fairly large series of cases of pulmonary tuberculosis. The results of these investigations proved of so much interest that it was decided to further extend these studies.

The oral and facial regions seemed to offer special opportunities. It was in this way that a peculiar nodular tumor was noted upon the hard palate in the mid line and extending to the junction of the hard and soft palate. This tumor was especially pronounced in some cases of pulmonary tuberculosis. The condition caused no especial symptomatology and was not even observed by the patient except in one or two cases where it was believed a gradual increase in size was noted and a slight change in speech occasioned by the growing tumor. A survey of the literature and consultation with nose and throat men did not reveal the identity of this condition, although it had been seen[11] but not correlated with any other condition.

The nails both of the hands and feet of many cases of pulmonary tuberculosis become inverted in the lateral grooves. The nails of the feet cause local pain by pressure which leads to the impression that the nails are ingrown, but further examination will reveal that the nail edge

is merely curved under upon itself and does not enter the flesh as is the case in ingrown nails.

The ingrown nail, a normal nail is occasioned by a true mechanical condition due to anterior and lateral pressure upon the toe by short shoes or stockings, differs from the hyperconvex nail, which is a truly pathological nail attaining its shape as a result of a possible pressure from underneath due to a broadening of the toe as a result of soft tissue and boney changes but mainly as a result of its changed consistency resulting from disease. The hyperconvex nails are brittle, often with yellow streaks at the bed made up of a soft "caseous" material. The chalky excretion under the nail and in the nail groove when present is dry and white and easily pulverised. The hyperconvex nails usually reveal accentuated lateral ridging which is especially to be seen on the hands while there is also visible a decided transverse ridging which occurs in waves and more especially to be seen on the feet. The multiple transverse ridges in the consumptive may in some way be related to the periodicity of the disease. Mixed ridging, both lateral and transverse, is usually only found in the large toe nails but may be present in all toes, rarely, however, in the finger nails.

The soft tissue manifestations of hypertrophic osteo-arthropathy are mainly seen in the distinct broadening of the distal end of the fingers and toes. They are aptly described by the terms drumstick or clubbed fingers or toes. The nails are either spread broadly over the clubbed ends of the fingers or toes or are markedly inverted on the lateral edges as a result of their lessened consistency. The anterior-posterior curvature is markedly increased in convexity and is aptly described as hyperconvexed. There may be an involvement of the soft tissues and nails of individual fingers of one hand or foot without symmetrical involvement on the other side. This is commonly seen. There may also be a marked involvement of the soft tissues of the tips of the fingers or toes with practically normal nails and vice versa. In many cases there is a broadening of the soft tissues in the vicinity of the proximal phalanges of the hands; whether this is due to the boney thickening or actual soft tissue increase in this vicinity could not be determined. On account of the deformity frequently occasioned by the wearing of short and narrow shoes which may produce more or less clubbing of the soft tissues of the toes it is advisable, except in pronounced cases, to forego conclusions until a complete examination of the hands and feet has been made. In the roentgenograph, however, a differentiation is easily made by the disclosure of obliteration of the interphalangeal joint in these cases. (See figure 20.)

There may be a hypertrophic condition of the soft tissues of the tips of the fingers and toes without any boney changes, and vice versa, corroborating Kessel's findings in this respect. Hypertrophic osteo-arthropathy of the boney structures of the hands and feet is manifested most in the burring of the distal ends of the terminal phalanges, which is a prominent factor in the production of the "clubbed" or

"drum-stick" fingers or toes. The periosteal thickening of the phalanges, especially in the proximal phalange of the hand and the middle phalange of the feet, is the next most common finding while the involvement of the metatarsals and metacarpals is less frequent. Often heavy spurs may be found at the proximal end of the terminal phalanges of the large toe. Rarely irregular new bone growth may be seen along the shaft of this phalange. In some of the more pronounced cases of hypertrophic osteo-arthropathy the proximal phalanges of the large toe may loose its concave sides and tend toward a cylindrical form with straight sides. Like the soft tissue changes the boney manifestations may be irregular, involving single toes, and unsymmetrically the hands and feet. In the hands when only one or two fingers are involved the boney changes are more pronounced usually in the middle finger, while in the feet the second toe is most involved.

These studies revealed that other foot conditions, not directly related to hypertrophic osteo-arthropathy, such as flat feet, are due rather to occupational conditions than to this disease, and the percentage amongst consumptives is not greater than among a group of non-tuberculous individuals. Acute and chronic foot strain was not found in the sanatorium group of patients since the ordinary rest treatment corrects this condition.

Callouses and corns were distinctly less frequent among this class of patients for the same reason. The complaints of ingrown nails in consumptives taking the rest treatment proved upon examination not to be true ingrown nails but the incurved nails of the hyperconvex type not burrowing in the flesh of the lateral grooves of the toes. Hyperhydrosis is not more common in a sanatorium group of consumptives than amongst a like group of healthy individuals.

In order to obtain information on the incidence of the various manifestations of hypertrophic osteo-arthropathy, affecting the hands and feet of consumptives in various stages of the disease and classified according to the activity and approximate duration of the pulmonary condition, the hands and feet of 102 cases of pulmonary tuberculosis patients in the National Jewish Hospital for Consumptives were carefully examined. The examination consisted of a careful study of the nails for the type and ridging and of the soft tissues for clubbing while the bone changes were studied in roentgenographs. The cases were classified as carefully as possible into the various stages of the disease, the presence of activity and the approximate duration of the disease and tabulated with the results given in Tables I and II. For comparison a series of 12 normal individuals were also studied with the results incorporated in Table I. The cases were further classified into males and females except in the incipient class, where the number of cases (7) were too few to permit of such division satisfactorily.

TABLE 1

Hypertrophic osteoarthropathy affecting the hands and feet of consumptives in various stages of the disease classified according to activity

STAGE OF DISEASE	NUMBER OF CASES	ACTIVITY	FINDINGS	NAILS				HYPERTROPHIC OSTEOARTHROPATHY			
				Type		Ridging		Soft tissue changes		Bone changes	
				Hands	Feet	Hands	Feet	Hands	Feet	Hands	Feet
Normals, male and female	12		+	0	0	12 lat.	10 lat. 2 trans.	0	0	2*	2*
			−	12	12	0	0	12	12	10	10
Incipient	7, 4 males, 3 females	+2	+	2	2	2 lat.	2 trans.	1	1	1	1
			−	0	0	0	0	1	1	1	1
		−5	+	5	5	5 lat.	5 trans.	1	3	3	4
			−	0	0	0	0	4	2	2	1
Moderately advanced	20, males	+6	+	5	5	6 lat.	3 lat. 22 mixed 1 trans.	5	5	6	6
			−	1	1	0	0	1	1	0	0
		−14	+	13	13	14 lat.	4 lat. 8 trans. 2 mixed	6	9	8	7
			−	1	1	0	0	8	5	6	7
	9, females	+3	+	3	3	3 lat.	2 lat. 1 trans.	3	3	2	3
			−	0	0	0	0	0	0	1	0
		−6	+	4	4	5 lat. 1 trans.	4 lat. 2 trans.	2	3	1	1
			−	2	2	0	0	4	3	5	5

Far advanced	42, males	+36	+	29	29	36 lat.	23 lat. 6 mixed 7 trans.	28	31	33	31
			−	7	7	0	0	8	5	3	5
		−6	+	6	6	6 lat.	3 lat. 3 trans.	3	1	3	2
			−	0	0	0	0	3	5	3	4
	24, females	+24	+	20	20	22 lat. 2 trans.	21 lat. 3 trans.	15	16	10	8
			−	4	4	0	0	9	8	14	16

* These changes were slight but definite, and in these 2 cases a history of a severe influenza was obtained.

TABLE 2

Hypertrophic osteoarthropathy affecting the hands and feet of consumptives classified according to the duration of the disease

STAGE OF DISEASE	NUMBER OF CASES	DURATION OF DISEASE	FINDINGS	NAILS				HYPERTROPHIC OSTEOARTHROPATHY			
				Type		Ridging		Soft tissue changes		Bone changes	
				Hands	Feet	Hands	Feet	Hands	Feet	Hands	Feet
Incipient	7, 4 males, 3 females	1 yr. or under (2)	+	2	2	2 lat.	2 trans.	0	1	2	2
			−	0	0	0	0	2	1	0	0
		1–3 yrs. (4)	+	4	4	4 lat.	4 trans.	1	2	1	2
			−	0	0	0	0	3	2	3	2
		Over 3 yrs. (1 tb. knee, 8 yrs.*)	+	1	1	1	1 trans.	1	1	1	1
			−	0	0	0	0	0	1	0	0
Moderately advanced	20, males	1 yr. or under (6)	+	6	6	6 lat.	3 lat. 2 trans. 1 mixed	5	5	6	4
			−	0	0	0	0	1	1	0	2
		1–3 yrs. (5)	+	3	3	5 lat.	1 lat. 2 trans. 2 mixed	3	3	3	3
			−	2	2	0	0	2	2	2	2
		Over 3 yrs. (9)	+	9	9	9 lat.	3 lat. 5 trans. 1 mixed	3	6	5	6
			−	0	0	0	0	6	3	4	3

Moderately advanced	9, females	1 yr. or under (1)	+	1	1	1 lat.	1 trans.	0	1	1	1
			−	0	0	0	0	1	0	0	0
		1–3 yrs. (6)	+	6	6	5 lat. 1 trans.	4 lat. 2 trans.	5	5	2	3
			−	0	0	0	0	1	1	4	3
		Over 3 yrs. (2)	+	0	0	2 lat.	2 lat.	0	0	0	0
			−	2	2	0	0	2	2	2	2
Far advanced	42, males	1 yr. or under (4)	+	4	4	4 lat.	3 lat. 1 trans.	3	3	3	3
			−	0	0	0	0	1	1	1	1
		1–3 yrs. (15)	+	10	10	15 lat.	13 lat. 2 mixed	12	11	12	11
			−	5	5	0	0	3	4	3	4
		Over 3 yrs. (23)	+	21	21	23 lat.	10 lat. 9 trans. 4 mixed	6	18	21	19
			−	2	2	0	0	7	5	2	4
	24, females	1 yr. or under (2)	+	1	1	2 lat.	2 lat.	0	1	0	1
			−	1	1	0	0	2	1	2	1
		1–3 yrs. (9)	+	8	8	7 lat. 2 trans.	8 lat. 1 trans.	7	7	6	3
			−	1	1	0	0	2	2	3	6
		Over 3 yrs. (13)	+	11	11	13 lat.	11 lat. 2 trans.	8	8	4	4
			−	2	2	0	0	5	5	9	9

* This case is in a boy with only small lung involvement but a tuberculous knee of eight years duration. He is classed as incipient because of the slight lung involvement which seemingly is the significant finding in H. O. A., while in standard N. A. class he would be classed as F. A.

FIG. 1

FIG. 2

FIG. 3

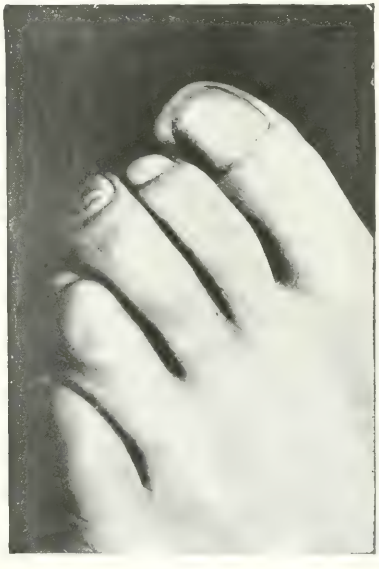

FIG. 4

FIG. 1. PRONOUNCED LATERAL RIDGING OF NAIL OF GREAT TOE WITH YELLOW CASEOUS EXCRETIONS UNDER RIDGES AND CLUBBING OF TOES

FIG. 2. PRONOUNCED TRANSVERSE RIDGING OF ALL TOE NAILS

FIG. 3. MARKED MIXED RIDGING OF GREAT TOE IN CASE OF ECZEMA AND PULMONARY TUBERCULOSIS, WITH CHALKY EXCRETION UNDER NAIL. MARKED TRANSVERSE RIDGING OF NAIL OF SMALL TOE

FIG. 4. HYPERCONVEX NAILS WITH MIXED RIDGING AND CLUBBING OF 3RD AND 4TH TOES ESPECIALLY PRONOUNCED

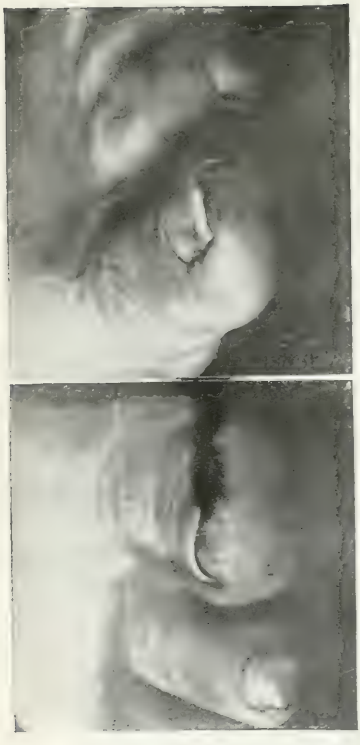

Fig. 6

Fig. 8B

Fig. 8A

Fig. 5

Fig. 5. Typical Ingrown Nail

Fig. 6. Typical Inverted Toe Nails of Pronounced Type, Showing the Curving under of the Lateral Edges

Fig. 7. Hyperconvexity of All Toe Nails with Lateral Spreading of Nails over the Clubbed Toes

Fig. 8 A. Left Foot with Clubbing of All Toes and Hyperconvexity of the Nails

Fig. 8 B. Right Foot with Same Condition as Fig. 8 A

Fig. 10

Fig. 12

Fig. 9

Fig. 11

Fig. 9. Pronounced Lateral Ridging of Finger Nails with Chalky Deposits under the Ridges

Fig. 10. Hyperconvex Nails and Clubbed Fingers with Lateral Spreading of Nails

Fig. 11. Thickening of Distal Phalanx of 1st and 2nd Fingers and Hyperconvexity of the Thumb Nail of the Right Hand

Fig. 12. Clubbed Fingers with Hyperconvex Broad Type of Nails

FIG. 13. SKIAGRAPH OF NORMAL HANDS

Note the fine pointing of the distal ends and the absence of roughening of the periosteum of the phalanges.

FIG. 14. SKIAGRAPH OF NORMAL FEET

Note the absence of burring on the distal phalanges and the graceful concavity of the shafts (periosteum) of the proximal phalanges.

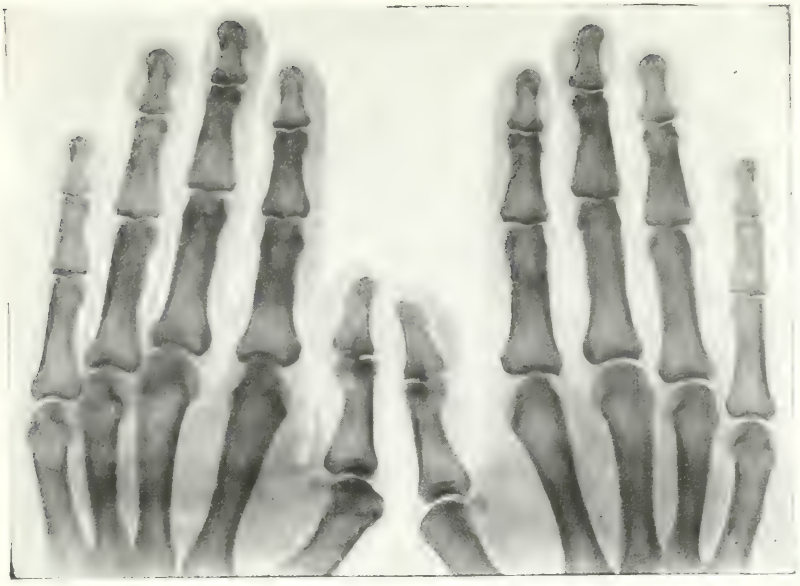

Fig. 15. Skiagraph of Clubbed Fingers

Note burring with spurs on the distal phalanges and thickening of the soft tissues at the distal ends of the fingers.

Fig. 16. Skiagraph of Clubbed Fingers

Note marked periosteal thickening of the proximal phalanges and soft tissue thickening of the distal ends of the fingers with burring of the tips of the distal phalanges.

Fig. 17A Fig. 17B

Fig. 17 A. Skiagraph of Hand of a Boy with Tuberculosis of the Knee for about Eight Years

Note periosteal thickening of all carpal and phalangeal bones and clubbing of distal phalanges.

Fig. 17 B. Skiagraph of Foot of Nontuberculous Leg of Patient of Fig. 17 A

Note periosteal thickening along shafts of phalanges and metatarsals and extreme width of proximal phalanx of great toe.

Fig. 18. Skiagraph of Clubbed Toes

Note extreme burring of tips of distal phalanges of all toes except great toe, which has definite spurs on base of distal phalanx. The soft tissues of the ends of all toes are clubbed.

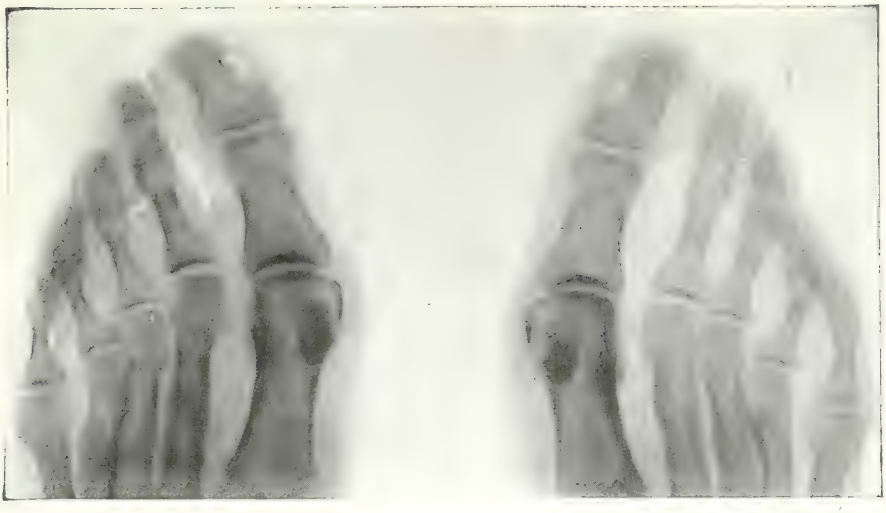

FIG. 19. SKIAGRAPH OF FELT

Note irregular bone formation along shafts of metatarsals, thickening of middle phalanges of 2nd and 3rd toes of both feet with obliteration of the concavity, and periosteal thickening of all the bones. The toes are clubbed, with burring of the distal phalanges.

FIG. 20. SKIAGRAPH OF A NORMAL FOOT WITH SLIGHT CLUBBING (NOT HYPERTROPHIC OSTEOARTHROPATHY)

Note clubbing of soft tissues of ends of toes and joint obliteration between the 2nd, 3rd and 4th toes of the right foot and of the 2nd and 3rd phalanges of the 4th toe of the left foot, occasioned by wearing short and narrow shoes.

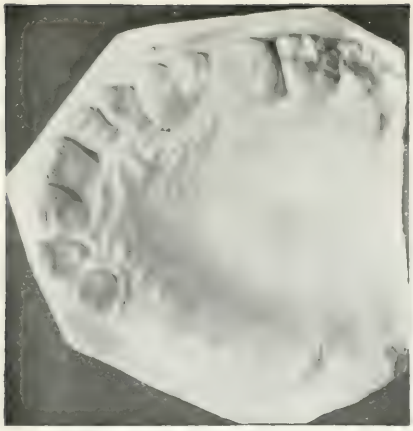

Fig. 22B

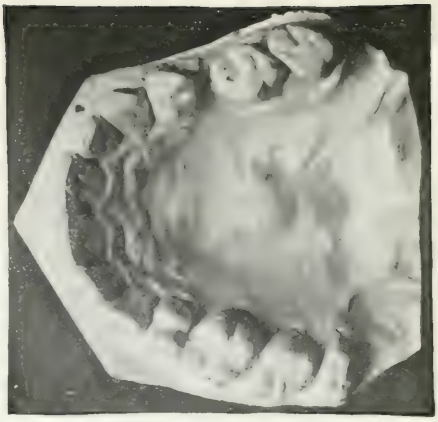

Fig. 24B

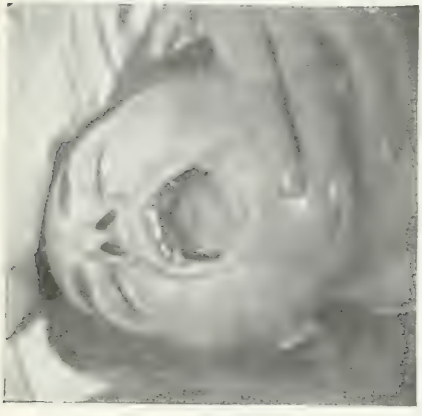

Fig. 22A

Fig. 24A

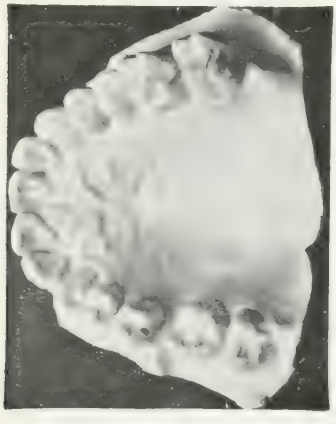

Fig. 21

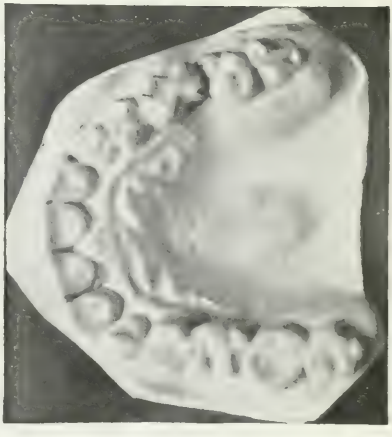

Fig. 23

Fig. 21. Plaster Model of Normal Roof of Mouth

Fig. 22 A. Photograph, to Show Tumor-Like Nodule of Hard Palate

Fig. 22 B. Plaster Model of Roof of Mouth (Fig. 22 A), to Show Teeth and Hard Palate with Tumor-Like Nodule in Midline

This is a case with slight enlargement

Fig. 23. Plaster Model of Roof of Mouth, to Show Moderate Sized Tumor-Like Nodule in Midline

Fig. 24 A. Photograph, Showing Tumor-Like Nodule of Hard Palate

Fig. 24 B. Plaster Model of Roof of Mouth (Fig. 24 A), Showing Pronounced Nodule in Midline

FIG. 25. PLASTER MODEL SHOWING NORMAL INNER PLATE OF THE ALVEOLAR PROCESS OF THE MANDIBLE

FIG. 26. PLASTER MODEL SHOWING ENLARGEMENT OF INNER PLATE OF ALVEOLAR PROCESS OF MANDIBLE, WITH OBLITERATION OF NORMAL CONCAVITY

FIG. 27. PLASTER MODEL SHOWING ENLARGEMENT OF INNER PLATE OF ALVEOLAR PROCESS OF MANDIBLE, WITH IRREGULAR HYPERTROPHY IN THE CONCAVITY

Tables 1 and 2 bring out the following points:

1. In consumptives there is found a high percentage of hyperconvex nails regardless of the stage of the disease. The incidence on the hands is exactly the same as that on the feet.

2. Lateral ridging of the finger nails is present to a slight extent in normal individuals and is merely accentuated in the consumptive. The same condition exists in the feet, where, however, slight transverse ridging is found fairly often in normal individuals. In the consumptive the ridging of the toe nails of the feet becomes more marked, and pronounced transverse and mixed ridging is much more frequent. (In the tabulation these points could not be brought out.)

3. Hypertrophy of the soft tissues of the hands especially to be seen at the tip of the fingers and thumb is practically absent in normal individuals (unless produced by mechanical and occupational means when it may be slight and the cause discovered by a complete examination), and is common among consumptives. This is also the case in hypertrophy of the soft tissues of the toes, seen most pronounced at the tip, being common among consumptives. The incidence of soft tissue hypertrophy is about the same in the toes and in the fingers of cases of pulmonary tuberculosis. The incidence of soft tissue hypertrophy is greater in the active than in the inactive cases of pulmonary tuberculosis.

4. The incidence of bone hypertrophy of the hands and feet especially to be seen as burring of the tip of the distal phalanges and periosteal thickening of the shafts of the phalanges and the metacarpals and metatarsal bones may be present to a slight extent in "so-called" normal individuals (as seen in two cases having had an acute pulmonary infection (influenza) a short time prior to the examination) but is common in pronounced degree among consumptives. The incidence of bone hypertrophy is about the same in the toes and in the fingers of cases of pulmonary tuberculosis. The incidence of bone hypertrophy is greater in the active than in the inactive cases of pulmonary tuberculosis.

5. No significant differences in the incidence of the manifestations of hypertrophic osteo-arthropathy in cases of pulmonary tuberculosis was noted whether the pulmonary condition had been of short (one year or under) or long (over three years) duration. A result of the study of the literature and Kessel's findings of malar thickening and globular nose formation especially in the more pronounced cases of hyperthrophic osteo-arthropathy in consumptives led to the belief that the hyperthrophic condition was generalized and that further study of regions heretofore unobserved, *i. e.*, the facial and oral regions, would lead to interesting findings. It seemed highly probable that the jaws might reveal something of significance. In this study of the oral and facial regions there were included 94 cases of pulmonary tuberculosis of various stages (National Association classification) and for comparison 12 normal individuals. The studies were divided into careful observations of the teeth, gums, boney processes of the jaws, hard and soft palate, tongue, nose, and malar processes. Roentgenological study was made in a num-

TABLE 3

Hypertrophic osteoarthropathy affecting the oral and facial regions in consumptives during various stages of the disease classified according to activity

STAGE OF DISEASE	NUMBER OF CASES	ACTIVITY	FINDINGS	ORAL REGIONS						FACIAL REGIONS	
				Teeth	Gums	Bony processes of jaws	Hard palate	Soft palate	Tongue	Nose	Malar processes
Normal male and female	12		+	0	0	0	0	0	0	0	0
			−	12	12	12	12	12	12	12	12
Incipient	6 (4 males, 2 females)	+1	+	0	1	1	1*	1	0	0	0
			−	1	0	0	0	0	1	1	1
		−5	+	1†	4	4	2	0	1	0	0
			−	4	1	1	3	5	4	5	5
Moderately advanced	18 males	+7	+	0	7	4	2	0	1	0	0
			−	7	0	3	5	7	7	7	7
		−11	+	0	7	0	0	0	0	2	0
			−	11	4	11	11	11	11	9	11
	7, females	+4	+	0	4	1	1	0	0	1	0
			−	4	0	3	3	4	4	3	4
		−3	+	0	1	0	0	0	0	0	0
			−	3	2	3	3	3	3	3	3
Far advanced	48, males	+44	+	1	39	21	10	0	5	7	5
			−	43	5	23	34	44	39	37	39
		−4	+	0	4	1	0	0	0	0	0
			−	4	0	3	4	4	4	4	4
	15, females‡	+15	+	0	13	6	8	0	3	4	1
			−	15	2	9	7	15	12	11	14

* Thickening centre of hard palate.

† Boy with tuberculous knee; incisors irregular and molars soft.

‡ There were no female inactive cases in the far advanced class in this series.

TABLE 4

Hypertrophic osteoarthropathy affecting the oral and facial regions in consumptives classified according to the duration of the disease

STAGE OF DISEASE	NUMBER OF CASES	DURATION OF DISEASE	FINDINGS	ORAL REGIONS						FACIAL REGIONS	
				Teeth	Gums	Bony processes of the jaw	Hard palate	Soft palate	Tongue	Nose	Malar processes
Incipient	6 (4 males, 2 females)	1 yr. or under (2)	+	0	2	2	1	0	0	0	0
			−	2	0	0	1	2	2	2	2
		1–3 yrs. (2)	+	0	1	1	0	0	0	0	0
			−	2	1	1	2	2	2	2	2
		Over 3 yrs. (2)	+	1*	2	2	2	1	1	0	0
			−	1	0	0	0	1	1	2	2
Moderately advanced	18, males	1 yr. or under (2)	+	0	1	0	0	0	0	0	0
			−	2	1	2	2	2	2	2	2
		1–3 yrs. (10)	+	0	8	4	2	0	1	0	0
			−	10	2	6	8	10	9	10	10
		Over 3 yrs. (6)	+	0	5	0	0	0	0	2	0
			−	6	1	6	6	6	6	4	6
	7, females	1 yr. or under (2)	+	0	1	0	0	0	0	0	0
			−	2	1	2	2	2	2	2	2
		1–3 yrs. (5)	+	0	4	1	1	0	0	1	0
			−	5	1	4	4	5	5	4	5
		Over 3 yrs. (0)	+								
			−								
Far advanced	48, males	1 yr. or under (7)	+	1	7	3	1	0	0	2	1
			−	6	0	4	6	7	7	5	6
		1–3 yrs. (16)	+	0	13	7	3	0	2	0	3
			−	16	3	9	13	16	14	16	13
		Over 3 yrs. (25)	+	0	23	12	6	0	3	5	1
			−	25	2	13	19	25	22	20	24
	15, females	1 yr. or under (3)	+	0	3	0	1	0	0	0	0
			−	3	0	3	2	3	3	3	3
		1–3 yrs. (2)	+	0	2	0	1	0	0	1	0
			−	2	0	2	1	2	2	1	2
		Over 3 yrs. (10)	+	0	8	6	6	0	3	3	1
			−	10	2	4	4	10	7	7	9

* Incisor notched and molars decayed.

ber of these cases but on account of the difficulty of interpretation revealed nothing of especial significance, and was discontinued. The cases were classified according to sex, activity and duration of disease. The results are given in Tables 3 and 4.

In the adult consumptive (contracting the disease after early childhood) the teeth revealed nothing of significance or possible of interpretation. In some cases the roots seemed to be more bulbous but whether this had anything to do with hypertrophic osteo-arthropathy could not be determined. As a whole the consumptive does not differ in structural tooth conditions from the normal individual. In children with tuberculosis the incisors were saw-tooth, and the crowns of the bicuspids and molars were irregular, and tooth decay more prevalent than normal, being almost coincident with rupture of the teeth.

Pyorrhoea alveolaris is common among consumptives both young and adult. The gums of the consumptive are in the majority of cases anemic and hypertrophied and do not bleed readily. Upon extracting teeth the socket is dry and does not bleed readily but seems to heal rapidly. The boney processes in a great many cases reveal a decided thickening which seems to be more pronounced in the superior maxilla than in the lower jaw or mandible. This reveals itself on the internal surface of the lower jaw first above a line at the level of the genial tubercle and extending around to about the first molar tooth obliterating the concavity above this line. The external surface of the lower jaw at about the same level thickens to a lesser degree. On the upper jaw or maxilla the thickening is more pronounced on the external surface following the concavity above the teeth, being more pronounced in the molar region. . The internal surface is less involved.

In about 25 per cent. of the cases of pulmonary tuberculosis the hard plate reveals a thickening located in the mid-line extending from the horizontal plate of palate bone to the foramen of Scarpa, situated in the anterior portion of the palatal process of the superior maxillæ, especially in pronounced cases. The tumor early may only be revealed as a slight elevation in the mid-line covered by an anemic mucous membrane, and sometimes can only be found by palpation. In the more pronounced cases the tumor situated in the mid-line is covered with a distinct anemic mucous membrane. The tumor is distinctly hard and bone-like to the touch. Its growth is so gradual that it passes unnoticed by the patient but may cause a slight change in articulation. Changes in the soft palate were extremely difficult of interpretation and the examinations, therefore, yielded nothing of especial interest regarding this part of the palate. Likewise, changes in the tongue were difficult of interpretation and only decided enlargement of this organ was considered and recorded as abnormal from the standpoint of hypertrophic osteo-arthropathy. The same was true in the case of the globular formation of the nose and the thickened malar processes. The figures in these cases are merely given for what they are worth and only indicate a possible deviation from normal.

Tables 3 and 4 bring out the following important points not noted above:

1. In consumptives there is found a high incidence of hypertrophic involvement of the gums which is slightly more pronounced in the active than in the inactive cases. The teeth show nothing of especial significance.

2. Hypertrophy of the boney processes of the jaws (mandible and maxilla) is fairly common in cases of pulmonary tuberculosis, the incidence being greater in the active cases.

3. Hypertrophy in the mid-line of the hard palate is fairly common among consumptives and the incidence is greater in the active cases which seems to correlate this condition with the general hypertrophic osteo-arthropathy.

4. There seems to be very little correlation between the above conditions and the actual duration of the pulmonary condition.

5. The condition of the soft palate and tongue could not be correlated with the general condition of hypertrophic osteo-arthropathy.

6. Although malar thickening and globular formation of the nose was noted, its relation to hypertrophic osteo-arthropathy could not be definitely established because of the difficulty in interpreting these conditions in the patients studied.

In order to better interpret the more important hypertrophic involvements of the hands, feet and oral regions two composite tables were made incorporating in percentages the positive findings classified according to the sex, the activity and the duration of the disease, from the previous detailed tables, 1, 2, 3, and 4. These figures are given in Table 5, classified according to activity, and in Table 6, classified according to the duration of the disease. These tables give the exact percentage incidence of the various hypertrophic conditions found in the entire group of consumptives studied.

Tables 5 and 6 emphasize the following points not discernible from the previous tables:

1. Hyperconvex nails of the hands and feet are found to the extent of about 75 to 95 per cent. in cases of pulmonary tuberculosis. The percentage incidence in the active cases does not differ materially from the percentage incidence in the inactive cases. The incidence in male and female is approximately equal.

2. Hypertrophy of the soft tissues of the hands and feet of male consumptives has a higher percentage incidence in the active cases (about 80 per cent.) than in the inactive cases (about 45 per cent.). The incidence in females, about 65 per cent. in the active cases and 40 per cent. in the inactive cases, is slightly lower than in the males.

3. The same holds true for bone changes of the hands and feet of male consumptives, active cases about 90 per cent. to inactive cases about 55 per cent., of female consumptives active cases about 40 per cent. and inactive cases about 30 per cent.

4. Hypertrophy of the gums is approximately of the same incidence in

TABLE 5

Composite table of the incidence of the most common manifestations of hypertrophic osteoarthropathy involving the hands, feet and oral regions of consumptives; classified according to the sex and the activity of the disease

SEX	ACTIVITY	NUMBER OF CASES	NAILS	HYPERTROPHIC OSTEOARTHROPATHY				ORAL REGIONS		
				Soft tissue changes		Bone Changes		Gums	Bony processes	Hard palate
				Hands	Feet	Hands	Feet			
			per cent	*per cent*	*per cent*	*per cent*	*per cent*	*per cent*	*per cent*	*per cent*
Male	+	43	81	79	86	93	88	90	50	25
	−	23	95	44	52	56	52	73	21	10
Female	+	28	86	64	68	43	40	85	40	45
	−	8	75	25	50	25	38	50	25	25

TABLE 6

Composite table of the incidence of the most common manifestations of hypertrophic osteoarthropathy involving the hands, feet and oral regions of consumptives; classified according to the sex and the duration of the disease

SEX	DURATION OF DISEASE	NUMBER OF CASES	NAILS	HYPERTROPHIC OSTEOARTHROPATHY				ORAL REGIONS		
				Soft tissue changes		Bone changes		Gums	Bony processes	Hard palate
				Hands	Feet	Hands	Feet			
			per cent	*per cent*	*per cent*	*per cent*	*per cent*	*per cent*	*per cent*	*per cent*
Male	1 yr. or under	12	100	66	75	91	75	90	46	19
	1–3 yrs.	21	67	76	67	71	71	81	45	19
	Over 3 yrs.	33	94	60	76	81	79	90	40	22
Female	1 yr. or under	4	75	0	50	50	75	80	0	20
	1–3 yrs.	16	94	75	75	50	38	75	13	25
	Over 3 yrs.	16	75	56	56	32	32	81	63	63

males, active cases about 90 per cent. and inactive cases about 75 per cent., and females, active cases about 85 per cent. and inactive cases about 50 per cent., although the active cases have a higher incidence than the inactive cases.

5. The same is true of the hypertrophy of the boney processes of the jaws (mandible and maxilla) the incidence being about the same in the male (active cases about 50 per cent., inactive about 20 per cent.) and female (active cases about 40 per cent. and inactive 25 per cent.), although the active cases have a somewhat higher incidence in both males and females.

6. The incidence of the tumor-like hypertrophy of the hard palate was slightly more prevalent in the female (active cases about 45 per cent. and inactive about 25 per cent.) than in the male (active cases about 25

per cent. and inactive about 10 per cent.). The incidence in the active cases was also greater than in the inactive cases.

7. No such correlation exists between the incidence of these various manifestations of hypertrophic osteo-arthropathy and the approximate duration of the disease, this factor seemingly being insignificant in contradistinction to the significance of the activity of the disease in the incidence of the manifestations of hypertrophic osteo-arthropathy of the hands, feet and oral regions of cases of pulmonary tuberculosis. (See Table 6.)

SUMMARY AND CONCLUSIONS

Hypertrophic osteo-arthropathy is a common secondary pathological condition in consumptives manifesting itself as a hypertrophy of the soft tissues and boney structures of the body with certain sites of predilection. It is probable that there are still many sites in the body which have thus far escaped attention.

The most common sites of predilection of the osseous manifestations of this associated pathological alteration in tuberculosis are the distal and proximal phalanges of both the hands and feet, the long bones of the arms and legs (Locke and Kessel), and the boney processes (jaws and hard palate) of the oral cavity.

The most common sites of predilection of the soft tissue manifestations are the tips of the distal phalanges of both the hands and feet and possibly to a certain extent the nose and malar processes (Kessel).

The toe nails and finger nails are also a common site of the manifestations of hypertrophic osteo-arthropathy; the expressions of this condition of the nail being an increased convexity of the anterior posterior curvature — "the hyperconvex nail" — a lateral broadening, and increased ridging both lateral and transverse.

Hyperconvex nails of the hands and feet of consumptives occurred to the extent of about 75 to 95 per cent. in the series studied; there being no difference in the incidence dependent upon the activity of the disease or the sex of the case.

Hypertrophy of the soft tissues of the hands and feet of consumptives has a higher incidence in the active (about 65 to 80 per cent.) than in the inactive cases (about 45 per cent.).

Bone changes of the hands and feet of consumptives are more common in the active (about 90 per cent. in males) than in the inactive cases (about 55 per cent. in males). The incidence of bone changes was less in the females than in the males.

Hypertrophy of the boney processes of the jaws in consumptives was greater in the active (about 50 per cent.) than in the inactive cases (about 20 per cent.).

A tumor-like hypertrophy of the hard palate was found in consumptives, apparently a manifestation of hypertrophic osteo-arthropathy which like the other manifestations of this condition had a greater inci-

dence in the active cases (about 45 per cent. in males) than in the inactive cases (about 25 per cent. in males).

No significant differences in the incidence of the manifestations of hypertrophic osteo-arthropathy in cases of pulmonary tuberculosis was noted whether the pulmonary condition had been of short (one year) or longer duration (over three years).

A complete study is essential to the diagnosis of hypertrophic osteo-arthropathy in consumptives because of the varied manifestations of this condition and the simulation of the individual symptoms by other conditions both mechanical and occupational. A roentgenological study for bone changes in the absence of external findings is essential to the making of a diagnosis of hypertrophic osteo-arthropathy as was pointed out by Kessel.

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DISCUSSION ON PAPER BY DR. CORPER, DR. COSMAN, DR. GILMORE AND DR. BLACK

Dr. George Mannheimer, New York: My remarks refer to the preceding paper as well as to this. A young woman developed a lung abscess after tonsillectomy. Within two weeks the first sign of the clubbing of the fingers was noticed, and within one month they were fully developed. The patient was treated by artificial pneumothorax and by rest on the roof of one of the New York City hospitals and recovered perfectly. The clubbing of the fingers disappeared within a year and a half completely. I take that to be one of the most satisfactory signs of the complete eradication of the disease. I wonder whether anybody has noticed the disappearance of the clubbing of the fingers with the healing of pulmonary tuberculosis. I would also like to know whether in Dr. Corper's cases the head was x-rayed.

The hypophysis regulates body growths, and it is quite likely that changes are found in the sella turcica in these cases of osteoarthropathy.

The Chairman: The Chairman would like to ask whether there is such a thing as inherited club fingers without any pulmonary disease. I have seen two cases which had run in families and in one case it went

back three generations. In another case there were two instances in the same generation without any pulmonary disease whatever, but at the same time no x-ray evidence of any change.

Dr. Corper: In reply to Dr. Mannheimer's question, roentgenographs of the head were made in many of the cases of hypertrophic osteoarthropathy studied by us but the interpretation of these proved difficult especially when dealing with changes such as might be occasioned by this condition, and this part of the study was abandoned for the present. That, however, such changes do exist seems highly probable and more exact studies will no doubt reveal their site of predilection.

I believe Dr. Mannheimer is correct in stating that this condition can gradually disappear. Its persistence or disappearance probably is dependent upon the duration of the secondary condition itself as well as the complete abeyance or eradication of the primary causative disease (tuberculosis, etc.). There are, no doubt, also other factors concerned which may account for the irregularity with which the secondary condition arises, for example, complete elimination of the causative poisons before they can act upon the sites of predilection. With the latter in mind we are at present studying the effect of liquid consumption upon hypertrophic osteoarthropathy and may have more to report in the near future. There is no question but that hypertrophic osteoarthropathy can disappear, and in developing does this very irregularly so that there does not seem to be a definite consistency in the order or form in which it appears or disappears. As is pointed out in the paper just presented these facts make it especially desirable to study the patient completely — clinically or physically and roentgenologically — for only in this way will bone changes be found in the absence of soft tissue changes, and a differentiation from other allied pathological conditions be possible.

In reply to Dr. Miller's question on the inheritance of clubbed fingers, I believe this condition exists, but if I remember correctly it involves only the soft tissues — bone changes do not occur in conjunction with this condition.

In closing may I again call your attention to the hard palate tumor? In order to obtain information on this condition I went to a number of laryngologists in Denver who told me they had noticed the tumor but were unable to tell what it was.

In elaboration of the above studies we are making plaster models of the hard palate tumor at definite intervals to note any changes occurring in this condition in the course of time.

LYMPHATISM AND TUBERCULOSIS

By Maurice Fishberg, M.D.

New York

Medical literature of the past twenty-five years abounds in statements to the effect that hyperplasia of the lymphoid tissue of the rhino-pharynx is one of the most potent predisposing factors in the evolution of tuberculous disease of the lungs. Many physicians insist that surgical treatment, in most cases implying complete removal of the lymphoid tissue in the throat, will prevent tuberculosis, and favor recovery from existing disease. For this reason operations on the nose and throat have been extremely frequent in those who suffer from pulmonary tuberculosis, as well as in those who are said to be predisposed to the disease.

Following these teachings, I have often referred tuberculous patients to competent specialists for the removal of the lymphoid tissue in Waldeyer's tonsillar ring. But during recent years my attention has been drawn to another phase of this problem. A large number of patients have stated that their lung symptoms made their appearance soon after operations of the sort just mentioned. That it could not justly be attributed to coincidence was apparently confirmed by another fact. Too many tuberculous patients who had been doing quite well, began to show manifestations of increased activity in the constitutional symptoms and extension of the lung lesions soon after operations for the removal of tonsils and adenoids were performed.

These clinical facts have led to further investigations on lymphatism and pulmonary tuberculosis, and it appears that there exists a certain etiological and prognostic relationship between the amount of lymphoid tissue in the throat and the development of tuberculous disease of the lung.

Hypertrophied lymphoid tissue in Waldeyer's tonsillar ring is a manifestation of the lymphatic diathesis, or *status lymphaticus*. Individuals with the lymphatic constitution are recognized clinically when the stigmata of the dyscrasia are well marked on the exterior of the body; when the bodily configuration and the distribution of the hair are heterosexual, the skin in the male delicate, the eye lashes long, etc. Some of the stigmata of this dyscrasia, such as hypoplasia of the heart and aorta, hyperplasia of the lymphoid follicles of the spleen, intestines, etc., can only be recognized with certainty at the necropsy. When the thymus is also more or less enlarged, and remains so at maturity, which is not infrequent in lymphatics, we speak of the *status thymico-lymphaticus*. These, however, are extreme instances of this constitution which are comparatively

uncommon. As in other congenital anomalies consistent with existence, there are various degrees of the lymphatic constitution. In some it affects many organs, the lymphoid tissues of the rhino-pharynx, the thymus, the spleen, the intestines, etc., while in others the tonsillar ring alone, the faucial and especially the lingual and pharyngeal tonsils, as well as the lymphoid follicles of the posterior wall and lateral folds of the pharynx, are hyperplastic. It is with the relation of these structures to the evolution of active pulmonary tuberculosis that we are concerned in this communication. In fact, it is the opinion of those who have studied the problem of lymphatism, like Paltauf,[1] Bauer,[2] Neusser,[3] Mosse,[4] and many others, that while this dyscrasia cannot always be diagnosed clinically with certainty, the hyperplastic condition of the lymphoid tissue in the tonsillar ring, especially when the lingual and pharyngeal follicles are found enlarged, is an indication of some degree of lymphatism.

However, one thing must be borne in mind in this connection. The faucial tonsils are very often found enlarged as a result of inflammatory processes in individuals who show no signs of anything like the lymphatic constitution. But in these cases, as a rule, it is only the faucial tonsil that is hyperplastic, and in many cases the enlargement is the result of frequently repeated acute and subacute inflammatory processes of the tonsils. In lymphatics the lingual and pharyngeal tonsils are enlarged and usually congested. This point should never be lost sight of when evaluating the relation of lymphatism to tuberculosis.

Lymphatics are very prone to acute infectious diseases, and when affected, succumb in larger numbers than others in whom the lymphoid tissue in the throat is not hyperplastic. This is the case with cerebro-spinal meningitis, diphtheria, scarlet fever, etc. Moreover, lymphatic children are very frequently scrofulous and rachitic.

On the other hand, though delicate and subject to various contagious diseases, lymphatics have been found singularly less prone to develop active and progressive tuberculous lesions in the lungs than others in whom the lymphoid tissue is normal. Autopsies reported by Bartel,[5] Symmers,[6] Emerson,[7] Ewing,[8] and many others, have shown that active tuberculous lesions of the lungs are extremely rare among lymphatics. Bartel has observed that among women who died from eclampsia, and also among suicides, an enormous proportion of whom are of the lymphatic diathesis, active tuberculous lesions of the lungs are strikingly rare when examined on the necropsy table.

Persons of the lymphatic diathesis are infected with tubercle bacilli as often as others. The fact that the tuberculin reaction is positive in them to the same extent as in others indicates that they harbor tubercle bacilli. Careful dissection at necropsies have shown that they, as a rule, have tuberculous lesions of the glands, lungs and serous membranes. But these lesions are, in the vast majority of cases, healed through cicatrization or calcification. It appears that in them the glands respond more promptly and more effectively to the infection. In many of these the infection is followed by disease. But it is the glands, bones, joints and

the serous membranes that are mainly affected, while the lungs are, as a rule, spared. When lung lesions are discovered at the necropsy in lymphatic individuals they show strong manifestations of the processes of repair.

It is important to recall in this connection that for generations clinicians have observed the extraordinary freedom from pulmonary tuberculosis of scrofulous children, and of adults who, during childhood, had been scrofulous. The rarity of scars on the neck, indicating past glandular tuberculosis, among tuberculous adults points in the same direction. Scrofula is considered a manifestation of lymphatism on which tuberculous infection has been implanted; it has been looked at as a defense reaction on the part of the glands of the body against the invasion of tubercle bacilli.

My attention to the relation of lymphatism to pulmonary tuberculosis has also been drawn recently by another clinical observation. In patients with active and progressive tuberculosis of the lungs, especially in the terminal stages of the disease, the throat is pale, and in many the sinus tonsillaris is excavated; hardly any tonsils are visible. Moreover, other lymphoid structures are almost never seen in the throats of these patients; there are no lingual tonsils, no adenoids, while lymphoid follicles on the posterior wall of the pharynx are extremely rare in tuberculous patients in the final stages of the disease.

A pulmonary lesion developing in a patient who lacks lymphoid tissue in the tonsillar ring pursues a very acutely progressive course. This clinical fact has such important prognostic bearings that it is worthy of further investigation. On the other hand, active pulmonary tuberculosis is now and then seen in patients with signs of the lymphatic diathesis; constitutional symptoms and signs of the disease may be in abundance, and tubercle bacilli may be found in the sputum. But when it is observed that the course of the disease is mild, the lesion shows marked tendencies to sclerosis. I am under the impression that these lymphatics contribute a large proportion of the favorable tuberculous cases, as well as the abortive cases of which more will be said later on. Hyperplasy of the lymphoid tissue in the throat is also at times found in patients with extensive lesions in the lungs of long duration. But here again the following peculiarities may usually be noted: In most instances the pleura is involved, at times the whole pleura is found thickened and adherent, while a large pulmonary cavity may be found in one of the upper lobes. It is, however, a striking fact that despite the extensive destruction of lung tissue, the patient is doing comparatively well, the constitutional symptoms are mild, while the lung in the opposite side of the chest remains singularly free from active tuberculous changes, which is rare in patients with extensive lesions but in whom the lymphoid tissue in the throat is normal or subnormal in amount.

In several lymphatics with tuberculous lung lesions of the type mentioned, operations for the removal of the tonsils and adenoids were performed, and the results were disastrous. The tuberculous lesions ex-

tended, the opposite lung was invaded by tubercle, while the larynx and intestines soon showed signs of infection. Many of this type of patients have recently been observed in private practice, while several are annually admitted to my hospital service in a moribund condition. They state that though tuberculous, they had been doing very well till the operation on the throat was performed.

To verify this observation I asked Dr. J. J. Wiener, one of my associates, to go over carefully all the patients in the tuberculosis pavilion of the Montefiore Hospital with a view of ascertaining the presence or absence of lymphoid tissue in the throat in relation to the activity and progressiveness of the lung lesions. He reported that those with hyperplasia of the lymphoid tissue in the throat are almost invariably doing well, or fairly well, despite evidences of extensive destruction of pulmonary parenchyma in some of the patients, while those in whom the lymphoid tissue in the throat is scanty or lacking are almost invariably going down. His observations led him to the conclusion that extremes, complete absence of tonsils on the one hand, and very much enlarged faucial and lingual tonsils on the other, bear out this rule more strongly than borderland cases. The statistical date thus collected will be published in due time.

It is noteworthy in this connection that patients with acute or chronic, but active, tuberculous lesions in the lungs only rarely suffer from the endemic and epidemic acute infections of the nose and throat. I have repeatedly observed during epidemics of coryza, grippe, tonsillitis, etc., that the vast majority of tuberculous patients escape though other members of their families are affected one after another. In sanatoria and hospitals for tuberculous patients it is a common observation during such epidemics that the personnel, the physicians, nurses, orderlies, etc., are laid up one after another, while among the patients the chances of contracting any of these acute infections of the nose and throat are in inverse ratio to the activity and progressiveness of the pulmonary process. Those having latent or mild lesions, showing but slight tendencies to extension, may suffer slightly from the epidemic "cold" or "grippe;" those with active disease only rarely contract the complicating infection, and then the "cold" is mild, hardly inconveniencing; while those with active and progressive pulmonary tuberculous lesion escape altogether, as a rule. This is observed in institutions where the chances of contracting the infection are about the same for all classes. An observant patient who had been tuberculous for many years, having gone through the usual exacerbations and remissions of the disease, told me that he believed that his lung lesion was in abeyance because he again became subject to attacks of coryza during epidemics. Somewhat similar observations were made during the epidemics of influenza of 1918-1920.

It is important to interpolate here that tuberculous patients often suffer from exposure. But in them the "cold" manifests itself in an exacerbation or extension of the lung lesion, and not as an acute inflammatory process of the nose and throat. In tuberculous patients who date back the onset of the lung disease to a "cold" it is almost invariably found

that the initial symptoms referred to the pleura, bronchi and lungs, and not to the nose and throat.

The relation of lymphatism to pulmonary tuberculosis is already noted during childhood. Between three and twelve years of age the lymphoid tissues are highly evolved and they promptly respond to nearly all infections. For this reason acute and subacute infections of the tonsils, adenoids and nasal mucous membrane are very common. And it is a striking fact that during this period of life pulmonary tuberculosis is exceedingly rare. Moreover, in the few instances that have been seen by the writer, the tonsils were small, almost lacking, the soft palate and posterior wall of the pharynx were pale, while hardly any lymphoid follicles could be discovered at the root of the tongue; adenoid vegetations are not seen in children with tuberculosis of the lungs. In some cases the sinus tonsillaris was so deeply excavated as to suggest prior radical tonsillectomy. Similar absence of tonsils to an extent as to suggest recent radical tonsillectomy is very frequently seen in adults with tuberculous disease of the lungs running an acute and stormy course. On the other hand, many children with hyperplasia of the lymphoid tissue in the throat often present symptoms and signs of tuberculosis of the intrathoracic glands, and the prognosis in these cases is very favorable. In rare instances there are signs of pulmonary involvement, but these parenchymatous lesions tend to sclerosis, and healing of the process.

The lymphoid hyperplasia characteristic of youth often recedes in quantity and activity when maturity is reached. The lymphoid tissue in the tonsillar ring atrophies more or less during adolescence. Many conservative physicians do not remove tonsils and adenoids in children indiscriminately because they anticipate that these tissues will probably atrophy after twelve years of age. It has been a very important observation of Bartel[5] that the atrophy of these lymphoid tissues is not in all cases accompanied by marked diminution in the size of these structures; he found that while the lymphoid cells are destroyed, they are in many cases replaced by connective tissue. Repeated inflammatory processes, which are not rare, may also convert the tonsil into a large fibroid mass with but few lymphoid cells. For these reasons, large tonsils in adults are not always lymphoid structures, as they are during childhood. But, as a rule, it is the faucial tonsil that is thus affected by fibrosis, the lingual and pharyngeal follicles are almost always glandular in structure.

It is noteworthy that tuberculosis becomes a chronic pulmonary disease just at the age when the lymphoid tissue in Waldeyer's ring recedes in quantity and in all probability in activity. Chronic pulmonary tuberculosis is a disease of human beings over fifteen years of age. Moreover, as was already intimated, persons in whom the lingual and pharyngeal tonsils remain enlarged and functionally active are only exceptionally affected with progressive tuberculosis of the lungs. When tuberculous disease of the lungs does occur, there are strong tendencies to sclerosis and healing of the process. Now and then we even see that the lung in such individuals is extensively involved, but even then the processes of

repair are apparently stronger than the destructive processes, and the disease pursues an exceedingly chronic course.

Many authors have maintained that the syndrome first described by Krönig[9] under the name of "collapse induration" is really an abortive form of pulmonary tuberculosis. The symptoms are those of early phthisis; physical exploration and radiography of the chest reveal signs of an airless area of lung tissue in one of the apices, most commonly the right. But the lesion never progresses beyond that stage. Krönig pointed out that this process is found almost invariably in mouth breathers who have nasal obstruction owing to adenoids, enlarged tonsils, etc.; they all have the characteristic facies of the mouth breather, enlarged and drooping lips, obliteration of the naso-labial fold, etc. In other words, it appears that "collapse induration" is essentially abortive pulmonary tuberculosis in individuals with the lymphatic constitution. In those in whom because of lymphatism the lesion in the lung is mild and tends to speedy cicatrization though tubercle bacilli are discovered in the sputum, we speak of abortive tuberculosis.

RECAPITULATION

1. Clinical observation and necropsy reports show that individuals of the lymphatic diathesis are only rarely affected with active and progressive pulmonary tuberculosis. Infection with tubercle bacilli produces fibroid lesions, and clinical manifestations of the disease are mild, showing that the processes of repair are very active.

2. The diagnosis of the status lymphaticus is very difficult, often impossible during the life of the patient. But hyperplasia of the lymphoid ring in the throat, especially the lingual and pharyngeal tonsils, may be considered as the most reliable clinical sign of the lymphatic constitution.

3. Infection with tubercle bacilli only rarely affects the lungs in lymphatic individuals, though glandular and osseous lesions are quite common. In the comparatively uncommon cases of pulmonary tuberculosis seen in lymphatics, the lesions are mild and tend to sclerosis.

4. When found in a patient with pulmonary tuberculosis hyperplasia of the lingual and pharyngeal tonsils is an indication of a good prognosis. In some of these patients the pulmonary lesion is aggravated soon after the tonsils are removed by operation. Many tuberculous patients date back the onset of symptoms of active disease to tonsillectomy.

5. Further clinical evidence in this direction is the rarity of coryza, and acute inflammatory conditions of the nose and throat in patients with active and progressive pulmonary tuberculosis.

6. In children, in whom the lymphoid ring in the throat is frequently hyperplastic, pulmonary tuberculosis is very rare; in adults, in whom the lymphoid ring is frequently hypoplastic, tuberculosis of the lungs is common.

7. In patients with far advanced pulmonary tuberculosis the tonsils,

especially the lingual and pharyngeal, are almost absent in the vast majority of cases.

8. Tuberculous infection of the lungs in lymphatic individuals produces an exceedingly chronic disease, running a benign course. In many the abortive type of the disease is observed.

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A WORKSHOP FOR THE REHABILITATION OF THE TUBERCULOUS*

By Grant Thorburn, M.D., and John S. Billings, M.D.

New York

The frequent recurrence of tuberculosis in those patients in whom the disease had been apparently arrested by sanatorium or other treatment has long been recognized as a grave problem by those interested in the treatment of this disease, but until the last decade but little has been done to rectify or even to improve this serious condition. These breakdowns are largely due to one or more of the following factors: (a) the change from the sanatorium routine and its hygienic conditions to the unfavorable habits and living conditions of the particular patient; or (b) the transition from the life at the sanatorium, where exercise is carefully regulated and the patient is free from responsibility, to the ordinary routine of a day's work, added to the fact that the responsibility rests on the patient himself, and may be complicated by domestic and economic worries; or (c) the patient returns to work that is unsuitable to his condition, or if he returns to his old work he finds that he has to work harder and longer than formerly with his efficiency impaired by his disease. Many of these unfortunate patients attempt to earn their living with "light outdoor work," and their pay is correspondingly "light," and they simply cannot live on it and take care of themselves and their families. Obviously, this state of affairs can best be attacked by well-planned after care, offered to the patient on his discharge from the institution, by placing him under excellent working surroundings and teaching him a selected trade under supervision. When he has learned to work and has successfully passed the dangerous phase in his treatment, his work should be remunerative enough to enable him to live under good conditions, to provide himself with enough good food to eat, and to put him in the position where he can really take good care of himself.

The large number of ex-service men suffering from tuberculosis whom the government was desirous of rehabilitating offered the opportunity of attempting to carry out such a plan of after care. The Federal Board for Vocational Education, recognizing this opportunity, suggested to the National Tuberculosis Association and to the New York Tuberculosis Association that a workshop for such rehabilitation should be established in New York City.

After considerable search a suitable loft was found, and the model

* This paper was illustrated by lantern slides.

workshop for the training of arrested cases of tuberculosis was opened on June 1, 1920. The plant is on the third or top floor of a new brick building in Long Island City in the midst of an industrial neighborhood that has recently been developed. The building is on the corner and situated within five minutes' walk of the Manhattan subway. The workshop has windows on all four sides, which insures a maximum of fresh air and sunlight; the equipment is modern and hygienic in every respect. A solarium and rest room have been opened on the roof, and a cafeteria lunch room is in operation where a well regulated and nourishing lunch is served to the men at cost.

The men training are almost all ex-service men who are taking their training with us under the Federal Board for Vocational Education. They are paid by the government an allowance to meet their expenses while training. This runs from $100 to $175 per month. Our plan is to pay the men when they become productive, when the goods they make are saleable, or the repairs they make are sufficiently satisfactory to justify paying them regular piece wages.

The personnel consists of a manager, assistant manager, three instructors — one in each department — a physician, a trained nurse, a cook and helper, and a porter to do the cleaning and heavy work about the shop. In addition to the above staff, a prominent business man gives valuable advice and able assistance to the institution, and the management also has the counsel of a committee of well-known dealers in the various commodities that we are manufacturing and repairing. Finally, there is a directorate of leading business men of New York City and also a committee of eminent physicians who are familiar with the tuberculosis problem.

The trades taught are watch repairing, jewelry manufacture, skilled cabinet making. These trades were picked out after great care and investigation; they are non-injurious to the lungs; they are well paid, and finally there is a great demand for workers in these trades. It is our aim to train these men in these highly specialized trades, for though the period of apprenticeship is by no means short, nevertheless, the longer we can keep these men under observation (within reason) and maintain their interest, so much the more gradually we can build up their work, and the more permanent, we hope, will be their health result. It is important to note that the men that we are going to turn out in these respective trades are going to be real artisans in these crafts, skilled workmen, and should have no difficulty in getting well paid employment. Industrially our results are very satisfactory; in each of the departments there are men who are doing excellent work; in all departments are some men who are having the "finishing touches" put upon their knowledge of the craft; there are several in each group who, if it were necessary, could now earn their living from their trade.

All applicants for the shop are put through a complete examination, in which careful and painstaking history is taken and a complete physical examination is done, including laboratory examination. Particular atten-

tion is paid to their previous training and treatment. The amount of work is ordered specifically by the physician. The minimum amount of work prescribed at present is two hours; our maximum is six hours. We believe that this is all they can do with the actual instruction going on, and we know that it is all the instructors can do. When the men earn some money we will increase them slightly more. The men are all examined at the end of the first week in the shop, and during this first week their temperature and pulse are taken every day.

All men are examined every month or oftener; this includes an examination of sputum. The nurse is at the shop every morning and facilities are at hand for emergencies. The nurse visits the homes of all the trainees, and gives them the benefit of her advice and experience as to the best use of their living facilities. The families are also benefited by her attention and examinations are made of the other members of the family, where it is possible. The medical attention given the boys attempts to remedy any defect found, such as any chronic infections or abnormalities of ears, eyes, throat, etc. Our social service extends even to obtaining convalescent care for others in the trainee's family where it is necessary or possible. We have also been able to find excellent rooms for our men in the vicinity of the shop. It is our aim to make this shop the same as any ideal sanitary workshop, and to maintain at the same time a close medical supervision of the health, living conditions, etc., of the workers; but we try to do this as unobtrusively as possible, and to keep the visible medical control in the background; the nurse, therefore, does not wear her uniform, and all examinations, except in emergencies, are made at the office of the New York Tuberculosis Association in Manhattan.

The workshop is to be the last step in the training and treatment of the tuberculous. Preparatory pre-vocational training is given to selected patients among the ex-service men in several sanatoria in New York State and Connecticut by the New York Tuberculosis Association. The training includes instruction for those men who wish it in the fundamentals of the workshop trades, so that when their disease is improved so that they may be discharged from the institution, they can enter the workshop with the minimum of delay. We hope in this way, through the benefit of the vocational therapy, to lessen the period of time in the sanatorium, and we hope also that this preliminary training will materially decrease the time required to teach them the trade, and that their period of non-productivity will be substantially shortened. We have had several men who became interested in the trades in the sanatorium through this training, were transferred to the shop when their conditions warranted it, and have subsequently done very well with us.

It is only possible to consider this a preliminary report; it is merely a statement of our results so far. A sufficient period of time has not elapsed as yet for us to be able to point definitely to certain men as economically rehabilitated, but we have a number whose progress has been remarkable, and whose health has been very satisfactory.

One hundred seventy-eight men have been referred to the workshop;

of this number 38 were rejected, 140 were admitted. Sixty-six are now in training. Twelve men stopped training on account of health; two of these were clearly non-tuberculous (thyrotoxicosis and decomp. cardiac).

Of the men who were rejected on application for training as unfit, totalling 38, 18 were rejected for active signs or symptoms, although they were referred as arrested or quiescent. Of this group 12 had positive sputa; the remaining 20 either had some disability that made training in our trades unwise, such as epilepsy, blindness, tubercular laryngitis, or else when they gave the matter further thought they were not interested in the trades.

Of those actually admitted to the shop (140) there are 66 men training now. Why this large turnover? It has not been due to their breaking-down, which has been relatively infrequent, but it has been due to the fact that after trying out the trade they elected they have either decided they did not like it, or else the authorities believed them to be inadaptable to it, or else after learning a little about the trade they have become impatient with the long period necessary to become proficient and have left to go out and take placement training, against our advice.

It must be remembered that we are dealing with men who are receiving a compensation from the government, which varies in different cases from $100 to $150 per month. While this compensation enables the men to live while they are learning the trade, and during the period when they are unproductive, it has also a tendency to make some of them very independent, and it is thus hard to hold them long enough to determine, by increased work under our supervision, whether or not their disease is really arrested.

The men are divided as follows: 17 are learning watch repairing; 34 jewelry; 15 cabinet making.

Of this group of men 55 have the diagnosis of pulmonary tuberculosis from the Public Health Service. The remainder are either considered by them as suspicious cases or else non-tuberculous.

Of the above group of 55 men, 24 give a definite history of a positive sputum and about 18 or 20 additional have rather definite physical signs, many of them substantiated by radiographic reports. Probably from 40 to 45 of these men are bona fide cases of tuberculosis. We have 21 men that have been with us less than three months, 19 men that have been with us from 3 to 5 months; 18 men that have been with us from 6 to 8 months; 8 men that have been with us more than 9 months. We have 2 men working 2 hours; 34 men working from 3 to 4 hours; 30 men working from 5 to 6 hours.

Of this total group of trainees, we find that 67 per cent. are maintaining or gaining weight, the other 33 per cent. are those who have either lost slightly, or else are questionable in their condition and are being watched particularly closely, and doing the minimum amount of work; or else in the absence of other symptoms, we believe that the loss in that particular individual is not of particular significance.

We have in training 12 men that have gained five pounds or more,

doing from 5 to 6 hours work per day. Of this number 8 give a history of positive sputum. We have probably from 8 to 12 men that are being watched particularly closely as they are not entirely satisfactory to us. Of this group of 12 men whose training was terminated on account of their physical condition, the reasons assigned are as follows: hemoptysis, three; signs and symptoms of activity, six; acute pleurisy, one; thyrotoxiosis, one; cardiac, one. (One man was doing well in his training, though a quiescent case, but we had to stop him because his sputum became positive; one man developed pleurisy while waiting to enter shop, was actually in shop few hours.)

It is interesting to note that of this group five-sixths of them had not had previous sanatorium care; five broke down within the first two months; three broke down within the first three months; three broke down within the first four months; one broke down within the first six months.

This very definitely shows, I believe, that not only can these men work, but that they are working. We have had to discontinue temporarily the training of several men for a period of a week to two weeks, but they have returned and have been able to work without any symptoms of activity.

We have not only to deal with the natural restlessness of the tuberculous cases, but also to combat in some their home and domestic conditions which act in a deleterious manner; for example, P———a, whose wife's condition will necessitate his transfer away from us.

CONCLUSIONS

Our scheme is practical, although we have as yet not had sufficient time to quote finished cases and to give definite numbers and examples of men who have left our shop to engage in the trade and hold their arrested condition.

Our purpose is gradually to increase the amount of work which the patient can do to a full day's work, while keeping his pulmonary condition in a state of arrest and teaching him in the meantime a well-paid trade — a trade that is numbered among the most skilled, and a trade which will enable him to get employment and at the same time be non-injurious to his lungs. During this instruction we aim to keep him under close medical supervision, and finally, when his disease warrants, to find him a suitable position. Then, trained, educated, hardened and reestablished in life, the danger of his again breaking down will be greatly diminished and he can take his place in the community rehabilitated not only in his health, but also economically.

ADDENDA

There are 26 men that have been with us six months or longer, as shown in the following table:

	LESION	NUMBER OF MONTHS IN TRAINING	AMOUNT OF WEIGHT GAINED OR LOST		NUMBER OF HOURS OF WORK PER DAY
			Gained	Lost	
1	Definite	8	16		6
2	"	6	same		6
3	"	6	11		6
4	"	7	10		5
5	"	7	9		5
6	"	7	10		5
7	"	6	8		5
8	"	11	8		3 temporarily
9	"	9	2		5
10	"	6	7		5
11	"	9	10		5
12	"	9	1		5
13	"	6	5		4
14	"	10		1½	6
15	"	7		1¼	5
16	"	6		1¼	4
17	?	11	1½		3 temporarily
18	?	6		3	3
19	?	6		7	5
20	?	6		5	3
21	?	10	½		6
22	?	7		3	4
23	?	6	1		6
24	?	7	13½		6
25	?	8	8		6
26	Non-tuberculous	8	4		6

Of these 26 men, 19 maintained or gained weight; eight on 6 hours; eight on 5 hours; one on 4 hours, and two on 3 hours (temporarily).

Sixteen have definite lesions, and 13 are on 5 or 6 hours per day.

Seven lost weight, an average of 3 1/7 pounds; 17 gained in weight; six gained 10 pounds or over (ten of the definite tuberculous cases have gained over 5 pounds).

Eight men were single; 18 married.

The above analysis shows that these men can work and maintain a satisfactory condition.

The Chairman: Opportunities are offered for those who are interested to visit the shop, and any of you who are particularly interested can get the exact instructions as to how to go, from Dr. Thorburn. The paper is open for discussion.

DISCUSSION ON PAPER BY DR. THORBURN AND DR. BILLINGS

Dr. Edward O. Otis, Boston: I should like to ask the doctor if in the case of those who were rejected or taken from the shop the sole reason was because they had tubercle bacilli in the sputum.

Dr. A. Trasoff, Philadelphia: Dr. Thorburn's paper is very interesting, especially for those who are now doing Federal Board work. I think very few people realize the importance of part-time training for the tuberculous ex-soldier. The conception hitherto, even of the profession, has been that as soon as a man was discharged from the hospital he should go and get an outside job, but no one realizes the insignificance of that statement unless he is put in a position where he has to put these men into training. To say, "Go and get outside work" does not mean anything at all. There isn't a single outside job that is suitable for the tuberculous upon his discharge from the sanatorium. The majority of patients who are discharged from the United States Public Health Service hospitals now, and have been for the last two years, are cases who are not fit to be classified as arrested, in fact, some of them are not even fit to be classified as quiescent; some of them have symptoms and signs suggestive of mild activity.

I have been with the Federal Board in Pennsylvania for the last eighteen months and I have had quite a good deal of experience in this work with the so-called arrested cases. It is my experience that men who have symptoms of the following, cough, profuse expectoration and rapid pulse, even though they have no temperature, should be considered as potentially active cases and not fit for any training at all. It is unfortunate that those patients were presented to us for training. Before proper supervision was set by the Federal Board those men were trained, at great detriment to their health; and not only that, but detriment to the public because we have to pay them compensation for a great deal longer period while they are getting well.

Fortunately, we were very careful in placing men in training, so that out of about 275 men in training I had only 25 cases last January or February that broke down. The reports from various other centers in the state show a good many more cases of reactivation and I believe the reason is because those men were put into training too early.

I think that those men who are in hospitals should be kept there until they are symptom-free, so that they can go out and engage in some occupation given by the Federal Board; but until then those Public Health Service hospitals which are fitted out with shops should keep the men under proper observation.

Dr. Thorburn spoke about home conditions. That is a very important point. I find that home conditions of patients are sometimes much more important than the training. They come home after five or six hours of training and indulge in some form of dissipation which causes breakdown

in health. The work our follow-up nurses are doing along these lines is bringing very good results.

Dr. M. Ward, Atlanta, Ga.: I have enjoyed the doctor's paper very much.

For some time I have been dealing with ex-service men who have suffered from tuberculosis and we find that men who are not under medical supervision for at least a few months after being discharged from the hospital break down more frequently than men who are under medical supervision in their training.

We have a training station at Waynesville, North Carolina, where we have medical officers and nurses, and we are able to keep those men in training longer. There are fewer breakdowns, and when they are discharged from their training center and take up their regular training we are able to keep them in training without breakdowns, much better than we could if we discharged them from the hospitals and had them take up regular training before going through a period in probation. Men who are in regular training are not so much under medical supervision. We have our follow-up nurses, who look after these men but we do not have a medical officer to follow them up. We find that men who are followed up in the training center by a medical officer do much better than the men who are not followed up.

Referring to the statement by Dr. Trassoff, that men are discharged from the hospitals apparently arrested before they actually are, that has also been our experience. When the men are inducted in training centers, we suggest to the educational directors that as they do not come up to the requirements physically, from a training standpoint, they be given light work, and then we follow the line of training men in the training center somewhat as is outlined in Dr. Thorburn's paper. One or two hours a day is given for rest period. I think the plan of training men under supervision, as outlined by the doctor, is the only feasible way of training them.

Dr. A. M. Forster, Colorado Springs: I don't see why some one doesn't bring up that beautiful old shibboleth about the eight hours that a man spends in work not being what counts, but the sixteen hours outside. When I used to talk on a kindred subject, I was always squelched with that.

It seems to me that an hour spent with Dr. Thorburn and Mr. Stein in the observation of the work that is being done in this shop is worth ten hours of constructive and destructive theorizing that is indulged in by a great many of our phthisiologists.

The first thing that impressed me when I saw the work that these gentlemen are doing was the fact that they had chosen such very difficult trades. We have always heard that it was impossible to change a man's occupation; that it was a most unwise thing to take him from the particular trade that he had been in before his illness and put him into another, and it struck me very forcibly when I noticed that in this case

three very difficult, highly organized branches of trade are chosen for these young men.

I think that we all noticed in the army that the vast majority of the men in the tuberculosis age had no fixed trade, had no fixed work that they were following, and that one of the points that we ought to consider is our duty while these men are wards of ours, as they are while they are under treatment. Not only must we look for conditions that accompany tuberculosis from the physical side, but also those that accompany tuberculosis from the mental side. I have always felt, while patients are under care in the sanatorium and under care in all of these after-care projects, that we must do something to improve their minds as well as their bodies, and unless we do that we are failing in some of the opportunities given us.

So I think it is particularly striking to notice that these gentlemen have chosen such trades as will make of the men, if they are successful, men of far greater and better power in the world at large than they could have been if left to their own devices. It is very impressive. I don't know but what it is a factor that makes for difficulty in this particular case, but as you have noticed from the doctor's results, he is succeeding, and it is particularly gratifying that he is succeeding in such a difficult piece of work.

Any one who will take the opportunity to look over the general situation that has been worked out by the New York Tuberculosis Association, in affiliation with the many other factors, will be struck with the wonderful completeness of the organization not only in this particular work that Dr. Thorburn is doing but also in the other workshop which is run on different lines and yet is as remarkably successful as his. One other factor, among many others, which I would call to your attention is the Home Hospital. It seems to me that we have come now to the point where one step further may carry us toward as complete as possible armamentarium in the handling of the tuberculosis problem.

However, I don't like one word that Dr. Thorburn used. He spoke of considering the workshop as the last step in the training and treatment of tuberculosis, and I hope before he publishes that paper, that he will reconsider that point. I think it is always a mistake (just as we made a mistake in thinking of the sanatorium as possibly the last step) to call any of these factors the last step in the treatment of tuberculosis because as time goes on, one additional step is always ahead of us to take.

Dr. Philip H. Pierson, San Francisco: Will Dr. Thorburn answer two questions which may be of interest to all of us? What part of this work is adaptable to municipal sanatoria where quite frequently the mental attitude of the patient is rather independent; also can he give us an estimate as to the cost per patient of this work to the institution carrying it on?

Dr. B. T. Crane, Rutland, Mass.: It seems to me there is no more opportune subject for the National Tuberculosis Association to consider than this very broad subject of reëstablishing the tubercular patient.

The subject is not entirely covered, I feel, by approaching it solely from

the point of view of this particular paper, *i. e.*, that of a workshop for arrested cases. Experience with the subject of reëstablishment of the tubercular patient will demonstrate that efforts aiming toward reëstablishment can be applied not merely to arrested cases but also to active cases.

The question has just been asked, what can be done in this line in municipal sanatoria? In my opinion all of this work will lead up to the dealing with this question in civilian institutions, and in our experience in Rutland perhaps the greatest part of the benefit will be with the active cases of tuberculosis, or at least with the open cases of tuberculosis. I do not mean to emphasize the idea of dealing with *all* active cases of tuberculosis, but with a specific type of open tuberculosis which the present armamentarium does not cover, specifically the fibroid chronic cases of tuberculosis which present the greatest difficulty, it seems to me, in a complete reëstablishment. That is the place for emphasis or retraining. reconstruction and reëstablishment

If my figures are not incorrect, I believe that an analysis of the majority of the institutional cases will demonstrate that about 70 per cent. of the cases coming to our state sanatoria are cases which are not capable of arrest during sanatorium residence. At least, those are the figures that I remember existed at the state institution at Massachusetts. I think that as medical men we have too largely emphasized and thought of the possibilities of healing tuberculosis. However, the fact remains that many of the cases presented to us (approximately 50 per cent. in Massachusetts) are already moderately advanced and approximately 25 per cent. are already far advanced before they come to us for treatment. An analysis of all those cases presents the fact that about 70 per cent. of the total number of our cases do not reach the arrested condition. Now what are we doing for that group that does not obtain an arrest? That is the place, it seems to me, where emphasis should be laid on this reconstruction work, and without attempting to elaborate, or really adequately to cover this question, it seems to me that one of the very first things for us to do is to arrive at a proper nomeclature.

There are no two students of this subject that I find who have a similar understanding of the nomenclature used. The English, Canadian and American nomenclature is different, and it is very confusing to have prevocational and vocational terms used in exactly the same sense and have vocational training confused with occupational therapy. Those are merely samples of the confusion that has arisen.

My final plea is to hold in abeyance decisions about this all-important matter until we at least arrive at a proper nomenclature.

Dr. I. I. Hirschman, Baltimore: I am considerably interested in the tuberculosis problem as it affects the ex-service man. It is my belief that a definite program must be set up before an attempt is made to solve the problem.

To my mind there are several factors: First, the grouping of cases. I think it is a mistake to train all tuberculosis cases in one particular way — there isn't any one way that I know of. First you must separate your

cases, those which are inactive or arrested from the quiescent. The quiescent case is an inactive case in the sense that he is free from fever and rapid pulse, etc., as laid down by the classification of the National Tuberculosis Association, but nevertheless he is a sick man and is at all times a potential case of tuberculosis. It makes very little difference what you give this type of case to do; in fact if he did nothing at all and stayed at home or in a sanatorium under the best of conditions, he could very readily go into an active condition in a few days for some unknown reason. Perhaps, as Dr. Krause intimated, the mechanical factor may be the cause of the breakdown with the result of the quick passing out of the patient. I am convinced that there are certain cases, particularly the quiescent ones, which we cannot train under present conditions. We must train them at training centers which we hope to establish; or perhaps adopt the colonization scheme, or perhaps a better term is the community plan or center. This will be a stepping-stone from the sanatorium and will act both as a place for training and convalescing — a try-out place, which will lead the man to some definite vocation.

The second thing we have attempted is the follow-up work. We make a special visit to the home of every tuberculosis and heart case; the flights of stairs, the housing conditions, the plumbing, etc., are carefully noted. We also link up with the State Tuberculosis Association, the Visiting Nurses Association, etc., in order to avoid duplication of work; and as far as possible we have the individual who is familiar with the home and who has handled the case previously take charge of the case. This avoids a great deal of confusion.

The third factor which we must consider is that many tuberculosis cases under the best of conditions can only be raised to a certain degree of efficiency. I know for a fact that we have numbers of cases with the Federal Board which we never hope to train to one hundred per cent. efficiency even though they may have the best background and the best educational training, which in turn makes vocational training easier. And yet, after two, three or five years' training under the most suitable conditions in occupations most suited to them, these men will only be able to do several days' work a week, or a certain number of hours a day for so many days. There will have to be some means in the way of compensation set up by the Federal Government for making up the difference in the amount they earn under the handicap and the amount they would earn were they one hundred per cent. efficient.

Dr. Thorburn: In regard to the first question as to why we didn't take the men with positive sputa into the workshop, the reason is chiefly because at the present time we have a plan to train arrested cases of tuberculosis. The cases we are training are really quiescent, apparently arrested or arrested. In the garment shop they are training men with positive sputa, and have been for two years, and they are doing very well. We felt that if we took men in with positive sputa, it would further complicate our work during the first year; that we might have some difficulty with

the patients and with the morale. We expect to be able to do it in the course of time.

Now as to the other question that the doctor asked me, in regard to whether or not we believed our plan feasible for the municipal sanatoria; we certainly do believe it is feasible. I see no reason at all why these men (and I am now expressing the opinion of the other men who are associated in this work, not my own) as they come from the clinics to the sanatoria should not be able to learn these trades. The majority of them ought to be able to. Unquestionably, some of them wouldn't be able to learn any trade. However, we feel that it would be worth any of the efforts that it would take, any expense entailed, to develop this in connection with various sanatoria.

Another question that the doctor asked me was regarding the per capita costs. That is a question that varies very largely with the particular number in training. The best way I can answer you is by telling you that the next year our budget is $35,000 for the running of this workshop, but this work is in the city. However, you must remember, that we are training men in the most skilled crafts and our instructors have to be paid high salaries. We can train 80 men for $35,000. We could train 100 men for $37,000 or $38,000 by adding an instructor. In the same way it is perfectly possible to start a development like this with one trade instead of three, and in that way you can cut down your overhead tremendously. Another thing that makes our work cost more is the fact that we are having our men handle and work with very valuable material such as watches and jewelry, etc., and the accompanying insurance charges are very high. Those are some of the things that make our overhead high for the group of men.

CLINICAL AND THERAPEUTIC ASPECTS OF THE FRAMINGHAM WORK

By P. Challis Bartlett, M.D.

Framingham, Mass.

In presenting some of the medical aspects of the Community Health and Tuberculosis Demonstration, it must be remembered that the Community Health Station has never offered, at any time, treatment, and that the principal part of the medical work at present is confined to the Consultation Service.

Whenever examinations are sought by the laity at the Health Station, they are never examined unless it is found that they are not under treatment at that time. If upon examination of such cases any disease is discovered, they are referred to a physician or to some clinic or hospital. The rest of the medical work is entirely at the request of the physicians.

In the early part of the Demonstration, as a result of the examination drives, draft, etc., 57 cases of tuberculosis were reported to the board of health during the first year. The average for the years preceding this time was 13 per year. At the present time, after four years of Demonstration work, it would seem that the average would be about 40 per year. In the early part of the Demonstration after the intensive work of the drives, etc., there were found to be nine or ten active cases of tuberculosis to every annual death. Since that time the number has fluctuated and has gradually decreased, and at present there are about five active tuberculous cases to every annual death.

Through the Consultation Service, although it is purely coöperative, the Demonstration comes in contact with most of the tuberculous cases in town. In studying the cases of active and apparently arrested disease placed on our chart during 1920 and the first four months of this year, it was found that 72 per cent. have been seen or examined by the community health examiner. From our experience it would seem that some of the remaining 28 per cent. will be seen, not for the purpose of diagnosis, but for advice and treatment and that our contact over a period of years would be not far from 90 per cent. The contact with the cases during the first four months of this year, for instance, has been 80 per cent.

In the work of this Demonstration it has of course been necessary to utilize some method for keeping track of our cases, and a chart has been devised, a description of which will be found in the back of the Diag-

nostic Standards Bulletin now published by the National Tuberculosis Association. In the study of this chart it will be noted that we have divided the tuberculous cases into a somewhat different classification than has hitherto been used. There are many reasons for doing this in a community-wide survey. "Incipient" tuberculosis cases, for instance, are the incipients of the National Tuberculosis Association classification. In the "early" group are most of those which it is impossible for the examiner to see. They may be placed on our chart simply through history or through having been reported to the board of health, the meagre information obtainable indicating that they are in the early stage. When more definite information is obtained, they are moved to the class in which they seem to fit under the National Tuberculosis Association classification. The "moderately advanced" cases are the moderately advanced cases of the National Association classification. In the "advanced" group we have divided them into rapid, slow and stationary. This is for the

TABLE I

Incipient Cases at the Time Demonstration Started and Discovered Since.

Present Status:

At home following advice — never in sanatorium	
Doing well	9
Doing poorly	1
In sanatorium at present	
Doing well	0
Doing poorly	1
Had sanatorium or hospital treatment — home now	
Apparently arrested	7
Progressive	1
Left town — moved away	14
Total	33

TABLE II

Early Cases at the Time Demonstration Started and Discovered Since.

Present Status:

At home following advice — never in sanatorium	
Doing well	18
Doing poorly	1
Unknown	1
In sanatorium at present	
Doing well	7
Doing poorly	0
Had sanatorium or hospital treatment — home now	
Apparently arrested	7
Stationary or progressive	3
Left town — moved away	11
Died	3
Total	51

purpose of following their clinical course, but the whole advanced group corresponds to the advanced cases of the National Association classification. In the "arrested" group we have placed them under "arrested advanced," and "arrested early." The reason for this would seem obvious in that it is our purpose to study carefully the group of arrested cases to see if possible under what conditions the arrested cases become activated in community life.

The accompanying tables will show something of the present condition of the cases that we know of at present in Framingham:

TABLE III

Moderately Advanced Cases at the Time Demonstration Started and Discovered Since.

Present Status:	
At home following advice — never in sanatorium	
Doing well	14
Doing poorly	1
Had sanatorium or hospital treatment — now home	
Apparently arrested	7
In sanatorium at present	
Doing well	3
Doing poorly	0
Unknown	2
Left town — moved away	16
Died	17
(Of this number 16 had hospital or sanatorium treatment.)	
Total	60

Of the total number above recorded 42 per cent. have had at some time sanatorium or hospital treatment. This so-called hospital treatment includes not only the treatment for advanced cases in sanatoria, but the two or three cases that have been treated in insane hospitals. It also includes one or two bone cases that have been treated in general hospitals for bone tuberculosis.

In the study of our arrested group of cases there are cases that have apparently been arrested during the time of the Demonstration and have again become activated after their apparent arrest. These have been studied with special care to see if it were possible in any way to understand the cause of their activation. From a careful analysis it is apparent that economic conditions have played little part in these reactivated cases, and even in those case where it has seemed to play some part, means could have been obtained, if the patients had so wished, whereby treatment could have been given them. Acute infectious diseases, influenza and acute upper respiratory infections have played a part in one or two instances.

In the study of the large number of arrested cases that have never shown any activation since the Demonstration started, it would seem that under ordinary conditions many cases of slightly active tuberculosis escape detection and go on to arrest. Many of them show histories of well marked periods of active disease, probably tuberculous, but in many instances they have never known that their trouble was tuberculosis. Histories, x-ray and physical examinations, however, indicate in many instances that they have had well marked disease.

In conclusion, the Community Health Station at the present time has

TABLE IV

Advanced Rapid Cases at Time Demonstration Started and Discovered Since. Present Status:

Had sanatorium or hospital treatment	
Doing well	1
Died	13
(Of this number 10 had sanatorium or hospital treatment.)	
Total	14

TABLE V

Advanced Slow Cases at Time Demonstration Started and Discovered Since. Present Status:

At home following advice — never in sanatorium	
Doing well	2
Doing poorly	2
In sanatorium at present	
Doing well	2
Stationary	1
Has had hospital or sanatorium treatment	
Apparently arrested	1
Progressive or stationary	4
Left town	3
Died	9
(Of this number 5 had sanatorium or hospital treatment.)	
Total	24

TABLE VI

Advanced Stationary Cases at Time Demonstration Started and Discovered Since. Present Status:

At home following advice — never in sanatorium	
Doing poorly	1
Doing well	1
Had sanatorium or hospital treatment	
Arrested at present	1
Died	2
(Of this number 1 had sanatorium or hospital treatment.)	
Total	5

under observation many cases of tuberculosis in all stages and forms, the largest group being the apparently arrested group, about 120 in number. We are studying all of the environmental and hygienic factors in these cases to see if we can find when they become active as well as the possible cause for such activations.

DISCUSSION ON PAPER BY DR. BARTLETT

The Chairman: Dr. Bartlett's communication is open for discussion. I would like to ask Dr. Bartlett what is the population of Framingham?

Dr. Bartlett: Seventeen thousand.

The Chairman: I think it is very interesting to begin to get these medical results and I think we all ought to feel a personal interest in these results as they come out of Framingham, because we must remember after all it is a National Association enterprise which these gentlemen are engaged in and one from which we hope a great deal in the future in the way of definite knowledge of what really a full-sized community program will be able to obtain for us.

In taking up the program this year, some of us thought that it would be a particularly opportune moment to discuss some phases of medical education in tuberculosis and consequently these next three papers have been prepared, to be presented together, in an endeavor to cover the subject as a whole. In the nature of a preliminary discussion, we will ask that the papers be delivered and we will have discussion on all of them together at the termination of the last paper.

UNDERGRADUATE INSTRUCTION IN TUBERCULOSIS*

By Walter C. Klotz, M.D.

Charlottesville, Va.

In January, 1920, a special department of tuberculosis was created at the University of Virginia in affiliation with a new tuberculosis sanatorium that had been established by the State Board of Health. This was located on a site about three miles from the University, near Monticello, the former home of Thomas Jefferson. Another historical fact that might be of greater interest to the members of the National Association is the fact that this site was the boyhood home of David R. Lyman and that the house in which he was "raised" is the present administration building of the Sanatorium, and I like to feel that Dr. Lyman's vibrations are still being felt at the Sanatorium and are exercising their influence upon its work and spirit.

Owing to the fact that the sanatorium was not open to patients until the spring of that year, practical work was limited to the out-patient department of the University Hospital. During the summer, however, a number of students worked as clinical clerks and assistants at the sanatorium. At the beginning of the last college year the sanatorium had been in operation for six months, was well filled and the course in tuberculosis instruction was definitely organized, the practical work being transferred to this institution.

It is not necessary to discuss *here* the need for such special instruction in our medical schools or the reasons therefore. This has all been discussed repeatedly at former meetings of the National Tuberculosis Association. The work covered by this report is in a way an answer to such appeals. It seemed of interest, therefore, to give a description of the course of instruction, the methods employed and the results that have been accomplished so far.

I want to remark, parenthetically, as long as I am going to be caught with the goods, that a good many of my ideas have been stolen from Dr. Allen K. Krause, and were taken from a former article of his on this subject. I don't think Dr. Krause is here, but I will take this occasion to acknowledge the valuable aid that has been derived from this work of his.

While some of those who have discussed the question of under-graduate instruction in tuberculosis have held that institutions with ward

* From the Department of Medicine, University of Virginia.

cases were not necessary, it has been our experience that such material was of the greatest assistance in the systematic presentation of the subject. It was always possible to select at will, groups of patients representing certain types of cases, combining in this way demonstration clinics, with the more practical, so called "Edinburgh" method, according to which all cases are worked up by the students themselves, and then presented to the section. Attempts were made, especially at the beginning of each course, to assign similar cases each day, in order to bring out consecutively certain features related to tuberculosis and by some method or regular order, instead of taking cases as they were admitted.

In arranging the course most of the work was thrown into the third year. The class was divided into four sections and each section covered one fourth of the college year. Sessions were held three afternoons a week, each session covering from two to two and a half hours. This gave about 50 hours of practical work for each section, in addition to the fluoroscopic examinations held once a week at the University Hospital. During the first few sessions of each succeeding section, systematic instruction and demonstrations were given in the examination of the chest. The different phases: inspection, palpation, percussion and auscultation with emphasis on the auscultatory cough were explained and the physical phenomena upon which they depend were discussed by the aid of blackboard drawings. Examinations were then made by the students themselves, first under supervision in order to correct errors of technique. At each succeeding lesson some new feature was added, in order not to confuse the mind with too many facts at once. The moving picture film used by the Army Medical Corps was also presented.

The principles and methods of history taking were explained and a scheme for the outline of the history given each student to use as a guide. The relation of family history, contact, predisposition, environmental factors, occupations, previous illnesses and former exacerbations, with types of onset were carefully brought out. The correlation of x-ray findings, clinical symptoms and laboratory examinations were then included as part of the examination. The students were expected to be present at the fluoroscopic examinations, in order to hear the description of shadows as dictated by the radiologist.

Later in the course as soon as they were more perfected in the methods of physical examination they were led to compare their own recorded chest findings with the stereoscopic plates and to check these against the official interpretation of the radiologist. In this way the relative significance of the various methods of diagnosis were brought out in a practical way. In order to crystallize the information thus gained, the students made out complete case reports, which were presented to the section in turn in the presence of the sanatorium staff for further discussion, criticism and comment.

Special topics were selected for discussion, such as: The difference between childhood and adult tuberculosis, artificial pneumothorax, var-

ious complications such as laryngeal and intestinal tuberculosis, the treatment of haemorrhage, the management of cases in different stages of tuberculosis, the classification of cases, the principles of the general hygienic treatment, tuberculin diagnosis and treatment and non-tuberculosis pulmonary diseases. A number of cases came to autopsy and the anatomical findings were compared with the signs as noted on the charts before death. This enabled the students more readily to interpret physical signs in terms of anatomical changes.

To stimulate study and research, articles from current medical literature were assigned to students for the preparation of abstracts which were presented to the section for discussion, in which the medical staff of the sanatorium frequently participated.

It was assumed that outside of the above course the third year and fourth year students would see various forms of tuberculosis in the course of general medicine and surgery and in the work of the special clinical branches. In order to serve as a general review and to crystallize all this sporadic knowledge, a course of six lectures was given at the end of the fourth year covering the general subject of tuberculosis. Special attention was paid to such topics as the history of tuberculosis during the different periods of medicine, biographical and bibliographical landmarks, the various conceptions of tuberculosis, the bacteriology and immunology, the tuberculin reaction, the serum reaction, anatomical changes, clinical types, evolution and development of clinical symptoms with a general consideration of the campaign against tuberculosis, the epidemiology, its relation to general and preventive medicine, public health, with a brief summary of the principal statistical facts.

This course of theoretical lectures was then followed by several demonstration clinics in the course of which an attempt was made to show by means of patients in different stages and of different ages, the possible history of tuberculosis infection in a given hypothetical individual, beginning with a healthy, tuberculin negative young child and leading through the stages of the infected, but not clinically active process, to the adolescent, young adult and older adult chronic types.

Shortly after the sanatorium was opened, it was agreed also that the University Hospital would assign one interne from its staff to the sanatorium for three months each in rotation. This plan of service has been most satisfactory. It has been the greatest stimulus to the medical work of the sanatorium to have on its staff a recent graduate well grounded in the fundamental sciences of medicine, and at the same time in touch with all the recent progress of general medicine and surgery; one who would be awake to note and discover inter-current conditions and non-pulmonary complications. This interne has acted as the liaison officer between the general hospital and the tuberculosis institution. Similar arrangements have been made between the nurses' training school of the University Hospital and that at the sanatorium. The student nurses from the sanatorium have had the advantage of taking the general theoretical courses with those of the University Hospital. Had it not

been for the universal shortage of nurses at this period, a rotation service, similar to that of the interne, would have been arranged, by which the student nurses from the University Hospital would have been assigned to work at the sanatorium in rotation. It is to be hoped that this feature will be carried out ultimately.

As far as the work and the interests of the sanatorium are concerned, we are well convinced of the truth contained in one of Osler's essays quoted by Thomas Futcher: "The work of an institution in which there is no teaching is rarely first class. It is, I think, safe to say that in a hospital with students in the wards, patients are more carefully looked after, their diseases are more carefully studied, and fewer mistakes are made."

It would be premature to judge of the results of our course, but it has been a source of satisfaction to note the interest shown in the work by the students themselves. It was demonstrated in the army during the war that short intensive training courses in tuberculosis were eminently successful and it would be only reasonable to assume that such knowledge obtained at a time when the mind of the student is most impressionable would stay with him through life. "The first clinical lessons usually sink the deepest if imparted methodically, clearly, logically and with proper explanation of phenomena."

POST-GRADUATE EDUCATION IN TUBERCULOSIS

By Edward R. Baldwin, M.D.

Saranac Lake, N. Y.

I am very glad to hear Dr. Klotz present really up-to-date information about undergraduate instruction in tuberculosis. He states the conditions as we hope they will be in all medical schools.

I will only touch upon the things as they are in most medical schools and the problem as it exists at present, and has existed since tuberculosis became a conscious specialty. The problem is a very simple one in this way: Practically most of the men who apply for post-graduate instruction are men who have been out of medical colleges or hospitals for at least five years, more often ten years, and to a large extent they are men who are about — on the average — forty years of age. I am glad to say, however, that there is an increasing tendency for younger men to take up a post-graduate course in tuberculosis, supplementing, as they find it necessary to do, the knowledge which they gain in the hospitals or medical schools.

Why is it that they did not gain this knowledge during their medical course before the last five years? In answer I need not say anything but remind you of what would be obvious if you gave your attention to the subject.

In the first place, tuberculosis is not a conscious speciality in the minds of most medical teachers. That is very necessarily so. It could not be otherwise unless the medical teacher is a specialist, as is Dr. Klotz, who has devoted his whole time to this subject. A teacher in internal medicine or a teacher of physical signs is obviously not likely to stress tuberculosis more than other diseases in the average case. He may have some special interest in tuberculosis; he may have had a relative or a friend or a member of his family who has had tuberculosis, or he himself may have had suspicious symptoms in his youth. In that way his attention has been directed to it. However, he is not the average teacher of physical signs or the average teacher of internal medicine in our medical schools of the past. Therefore, the student does not get in medical school a perspective of tuberculosis as a special subject, or has not done so in the past.

The second reason is that in the average medical school which is located in a large city, there are very few cases, except in the dispensaries, that are under constant observation of the teaching force of the medical college. They are not under observation as they are in a san-

atorium, for months at a time, or in a tuberculosis hospital; they are relegated generally to a chronic ward where they are neglected or no special attention is given to them. The student does not feel interested, cannot feel interested in that kind of patient, unless his attention is, as I have said before, especially directed to the case by an unusual teacher.

This attitude of casual interest in tuberculosis has long been the reason, no doubt, why the medical graduate, up to five years ago, or up to the present time, has not had a fair deal in his instruction in tuberculosis. I think I am not mistaken, and I think you will all agree with me, when I say that medical men who have been out of college for at least ten years did not really get very much interest in tuberculosis during their school course.

If we make tuberculosis a paramount study among those subjects of internal medicine which are taught, there might be a different story to tell. It is evident that something is being done in that direction now; endowments are being created for a special instruction in tuberculosis in certain medical colleges, but as far as post-graduate instruction at the present time is concerned, we find that because of lack of time on the part of the student while he was a medical student or an interne in a hospital, he did not get very much tuberculosis training, his attention having been directed to more interesting or (in his mind) more important matters. However, let that man get tuberculosis himself or let some member of his family get tuberculosis and immediately his attitude changes and he awakens to the idea that he did not know very much about it. What is the result? He casts about, if he was a patient himself and he recovered his health, for some place where he can get special instruction.

So far as the post-graduate tuberculosis instruction is concerned, the problem is not very different from the post-graduate instruction in some other disease, e. g. in surgery, or in venereal disease, in neuro-psychiatry, or in some other speciality. In other words, the man has to feel the need before he intends to go into it: before he gets an interest in post-graduate work. Then he finds that he is lamentably weak; he somehow or other does not know what the physical signs are in tuberculosis; he does not feel sure of himself. He got physical signs, to be sure, in his medical work, but he did not in some way get enough instruction or devote enough attention to enable him to be sure of hearing things in the lung, or to detect tuberculosis in his own way. A fair number of the men who wish instruction in post-graduate work in tuberculosis are constituted of those in whose family some member has had tuberculosis. That is our experience in the Trudeau School during the last six sessions. In the forthcoming session, (the seventh session), at least one-third of the men have had tuberculosis themselves. During some of these sessions more than one-half of the men have had tuberculosis. The rest of the men in earlier sessions were men who had some attachment; either they had an appointment, or were already in charge of some in-

stitution; or they had some connection with an institution for tuberculosis.

Today the situation is very much the same, but, as I said before, there is increasing demand on the part of men who have no special connection with tuberculosis institutions, who wish to perfect themselves in the diagnosis and the treatment of tuberculosis.

As I said, the average man who has been out of college from five to ten years has somewhat vague ideas as to what he hears in the lungs in a case of early tuberculosis. You don't have to tell him what advanced tuberculosis is; that is something that he has already got in mind, but his recognition of physical signs seems to be the thing which impresses him as his weakness, and I venture to say that the majority of the men who take up post-graduate instruction in tuberculosis primarily wish to know more about physical signs and what they mean. He wants to be able to diagnose the diseases early; he may have made some mistake which impressed him very much, or he may have failed in some cases.

Then his interpretation of what he hears and the difficulties that have been coming up in the differentiation of tuberculosis from post-influenzal cases and other forms of pulmonary disease have impressed him more and more — the conscientious medical man at least — with the fact that he needs something additional to what he got in his college.

There is another reason, I think, for the need of post-graduate instruction, which I do not think will be met by under-graduate instruction. The curriculum of our medical schools today is so filled with clinical instruction on acute diseases of real interest and importance, that there is possibly very little time to give very much to a special disease. There may be in some instances a student who will find that he can get enough time in his course to give especial attention to tuberculosis, but there is no doubt but that the mass of men will not go through college and get special knowledge of any one subject to the exclusion of any other, unless they do exclude all others. Consequently, I do not think there is any doubt but that there will be need for post-graduate instruction in tuberculosis for a long time to come. It requires not only considerable study, but it requires a good deal of attention to that study, fixed attention as well as concentration on it, to attain any great knowledge of the differentiation of tuberculosis, for example, from other diseases.

So far as the men who are connected with an institution are concerned, there is an entirely different demand, and that is, men want to know how to run institutions for tuberculosis, and these men have had perhaps no experience whatever excepting experience in a hospital for other diseases. They desire to get the atmosphere of a tuberculosis institution. They cannot get it without serving an internship in a tuberculosis institution, and many of them haven't time for that. The result is that it seems as if, from the demand which is now increasing all the time, there will be a long period before tuberculosis will be handled as an undergraduate study in a sufficiently thorough manner to

make post-graduate study unnecessary — or at least unnecessary only for those who are not special phthisiotherapists and do not expect to make a life work of it. Thus far, there have been these two classes.

I might have said also that when the Trudeau School first began its work there were a number of applications from men who seemed to be mostly interested in learning how to give tuberculin treatment; they wanted to know how to dose the tuberculin and make a specialty of treating tuberculosis with tuberculin. There are not so many now. Then there was quite a large number whose only interest in tuberculosis was a study of the x-ray pictures. They, however, became interested in other phases of tuberculosis after they had their ideas and x-ray knowledge better fixed.

The reason why men want and need tuberculosis instruction in a post-graduate way are, of course, various, but these are just some of the questions that have come to us in the Trudeau School during the last four years. It is very gratifying that in different parts of the country there has been an increased interest in post-graduate study of tuberculosis. We have now in Colorado the Colorado School of Tuberculosis. There is no doubt a greater effort in all the medical colleges to establish post-graduate courses, summer semesters of which have been established in various centers, where a man can get these things. Certain things seem to be necessarily connected with institution life; other things can be done in dispensaries, but for a well-rounded knowledge of tuberculosis there is at least at present a very definite field, apparently, for a post-graduate course in an institution for tuberculosis, conducted by men who have had the disease, and to a large extent, have spent their lives at that work.

SOME PROBLEMS OF MEDICAL EDUCATION IN TUBERCULOSIS[1]

By Allen K. Krause, M.D.

Baltimore

An increasingly active interest in tuberculosis has brought about a marked improvement over conditions which existed only a very few years ago. The Trudeau School, the pioneer institution for formal instruction of graduate students, is only five years old. The need and demand for it and its usefulness may be estimated by the fact that applications for enrollment far exceed accomodations, and by the establishment and plans for establishment of similar schools in a number of other localities. The Massachusetts and New York plans of consultation and itinerant clinic services have been notably successful, and enlightening and stimulating to general practitioner and tuberculosis expert alike, and will bear copying and development everywhere. Those in charge of the tuberculosis activities of the Army and United States Public Health Service have been alive to the educational possibilities presented by a wealth of clinical and autopsy material, and have been quick to turn it to effective use. The number of inquiries which one receives from medical schools concerning methods and courses of instruction in tuberculosis is becoming impressive and is, one may hope, highly significant of future development.

Many indications, therefore, point out that we are already well along, — further along, perhaps, than we think. It is, at the same time, only too apparent that many changes, something of the nature of a reconstruction — of methods, of standards, of values — must be brought about before we may admit that we are making the most of our opportunities or that we are teaching tuberculosis with anything approaching complete effectiveness. It may not be given human endeavor to attain complete effectiveness, yet there should be little doubt that a standard of perfection should always be our model; nor, for this reason, should I be inclined to defend any ideas which I may present against the criticism that they comprehend a standard of perfection. Appreciative of all that has been done in the way of education in tuberculosis, I am vastly more interested in whatever will make tuberculosis an object of productive study and teaching wherever the physician comes in contact with it.

[1] From the Kenneth Dows Tuberculosis Research Fund, of the Medical Clinic of the Johns Hopkins Hospital and University.

Individual ideas of what constitute problems of education in tuberculosis are likely to be colored by two prejudices. These arise from the personal attitude which everyone of us has formed toward the age-long controversy over the purpose and direction of education in general, and from those particular interests in tuberculosis which your or my study and practice of it have brought out and developed.

Any one of you may intuitively disagree with whatever position I may take on whether the general purpose of education should be to fashion personality or to perfect machinery — to spread before the plastic intelligence the accumulated stores of all sowers and reapers of the past, or to take the twig at its first budding and incline it in a definite and special direction. The question will never be settled; and, after all, why need it be? — for the pathfinders, the seers, the geniuses, the "self-educators," resisting all discipline, conforming to no rules or systems, whipped on by irresistible impulse and spurred to colossal industry, will lay at our feet what our planned endeavors with thousands have failed to produce.

For the moment I forget who it was — perhaps it was Kant — who said that in teaching he was concerned only with average men, inasmuch as there was no hope for fools and geniuses would take care of themselves. We may or may not subscribe to this view. Yet it is quite likely true — or, at any rate practical — that, when considering the persons to be taught, we should keep our eyes fixed on the needs of the average man. As a routine procedure, it would be as foolish and mistaken to prepare banquets for Louis Pasteurs as alphabet noodles for our Sabbath entertainer, Mr. McNutt.

Any educational plan requires that we give earnest attention to something more than the needs of the student. This something is comprised in the best interests of the subject to be taught. And, although the needs of the student and the best interests of the subject may not be capable of dissociation, it is my diffident opinion that, in approaching the matter of education in tuberculosis, we are under far greater obligations to think and act from the point of view of what may be best for tuberculosis — what will ultimately advance the knowledge and science of tuberculosis — than to any course which may promise to be immediately practical, enlightening and advantageous for the student. I have no doubt that, in our lifetime at least, students will come and go while tuberculosis will maintain its rôle of the poor in our midst. I have just as little doubt that the more quickly and more securely tuberculosis takes a higher rank among the scientifically-pursued branches of medicine, the more it will attract a larger body of able students and investigators. As I see it, the best interests of all concerned — patient, student and practitioner — demand that the lines of tuberculosis study and practice be tightened all around, that requirements for both the latter be raised and made more difficult, not simpler.

I am constrained to state this for two reasons. The first is that I am continually being reminded that the average internist does not enter-

tain a particularly high opinion of the medical knowledge and ability of the professed practitioner and student of tuberculosis, and, while you may say that we reciprocate the feeling, this retort does not alter or amend the situation. Besides, it is our own knitting that we are primarily concerned with.

The second reason is the free and easy — I almost said, irresponsible, — conception of tuberculosis teaching which many seem to hold. If I have understood them correctly, I have gathered from not a few contributions on the subject that, by playing the stethoscope over certain infallible areas of the chest for an hour or two a day throughout a week or two, yokels are converted into diagnosticians of tuberculosis; or that a few easy tricks with the fluoroscope and the acquirement of a catchword or two will open up the realms of pathology, etiology, diagnosis and prognosis; or that fifteen minutes with motion pictures will accomplish what formerly "took twenty-four lectures of one hour each"; or that a demonstration of how to stain the tubercle bacillus and how to inoculate it into a guinea pig makes an investigator out of a novice. Now, all this may be true; yet I can't believe it. Perhaps the fault lies with me, as I am led to survey my own deficiencies and inefficiencies as a drillmaster. Yet I am encouraged to take heart as I reflect on the possibilities that might arise out of a case, up for opinion, before Webb and Minor and Brown and Hamman and Baldwin and Miller — when I consider the six different histories, the six different exercises with the stethoscope, the six different x-ray plates — and then the weighing of all the evidence in the balance of six individual experiences — and finally the opinions as to diagnosis, and after diagnosis as to what is to be done with the case, and then — all important perhaps, for the patient and his family — the prognosis. I verily believe that, if what many have told us about the short-cuts to a knowledge and practice of tuberculosis is true, the event would show that these six eminent practitioners had flagrantly abused their opportunities to learn or had been singularly refractory to newer, sure-shot methods.

Now, tuberculosis should and must be taught to medical students, to medical practitioners, and, perhaps, even to patients, and it is our job to devise ways and means to teach all three, practically and effectively, while we at the same time send tuberculosis along as a developing and attractive subject. It takes comparatively little wit — or conscience — to set down on paper comprehensive and ideal courses. I have already done this several times, and expect again to commit the same misdemeanor before tuberculosis and I finish it with each other. It is easy to pass resolutions, even with one's self; but discouragingly hard to make them work, no matter how embellished they may be. At the present time I shall put aside the temptation to reissue a program of instruction. I had rather point out problems which may confront the practical working out of programs.

Let us consider, first, the case of the undergraduate student.— What would you have him do?

Throughout the literature there is distributed an enormous amount of gloom over the new graduate's inability to make a diagnosis of pulmonary tuberculosis. But is it justified? I'll grant that a fourth year student who fails to detect the disease because he does not know how to find bacilli in a positive sputum, or who "misses" the cadaverous consumptive who is so plain that his lay home associates have no doubt that he "has the bugs," has been inefficiently instructed or is a numskull. But to expect him to proceed in a business-like way to make a diagnosis of a difficult or questionable case of lung tuberculosis is as irrational as to trust yourself to him for the removel of your appendix or your brain tumor. Beyond their veriest rudiments the technique and judgment of tuberculosis diagnosis can no more be acquired by the average undergraduate student than can surgical technique and judgment. If tuberculosis — in any of its phases — were so easy as some would have us believe, it would not have long ago become a special branch of internal medicine. Everyone of us here has sweated — and is still sweating — to gain what little he knows about tuberculosis — throughout the long years devoted exclusively to tuberculosis. Then why be so hard on the undergraduate or so contemptuous of his training? The quicker we appreciate that physical diagnosis cannot be learned from didactic lectures, or parallel columns of signs, but that competency in it can be attained in only the same way as a proficiency in operative surgery, that is, by assiduous observation at the autopsy table and practice on the living patient — just as Laennec erected its foundation — the sooner we'll be in line to formulate plans for the most effective instruction in pulmonary tuberculosis, especially for undergraduates.

It has no doubt happened, not infrequently, that Professor X., new head of the tuberculosis department, animated with all the enthusiasm that whole-hearted devotion to his subject can give him, has entered the faculty meeting which is to plan the curriculum for the coming year. Passionately determined to see it through, he sits down with a course of instruction in tuberculosis which he is convinced represents the minimum that a medical student may be given before he may be turned loose upon the public. Around the same table are a dozen or score of other heads of departments. Professor A., of genitourinary diseases hasn't the least doubt that a medical student who cannot cystoscope a man with comfort and profit to the patient is unfit for graduation. Professor B., of pediatrics, considers that graduate a menace to society, who, when first called in, might confuse chickenpox and smallpox. Professor C., of laryngology, insists that since adenoids, enlarged tonsils and other nasopharyngeal affections are the most common disabilities of human beings, he must have a full third of the student's time to impress the latter with his responsibilities. Professor D., of ophthalmology, makes out a strong case when he points out that the normal human eye exists only in the textbooks and that the least he can expect of the student is his taking a full course in refraction: he may waive instruction in minor complaints like pink eye and leave this to the pediatrician. And so it

goes — from anatomy to x-rays, with the professors of the two major subjects of medicine and surgery silent and wondering how they are to squeeze in an occasional hour to tell the student how to treat a headache or a boil on the neck.

The result is a compromise; or once in a while, if you will allow vulgar but expressive terminology, a "freeze out." Professor X., if he has his wits about him, is brought to see that medical education to-day is concerned with a great deal besides tuberculosis, and that, in a school of medicine, there are even some reasons for looking upon a tuberculosis department as exotic and a luxury. I bring up this particular situation as a problem because it is a most real and practical one, yet one which most homilies on what should be taught undergraduate students in tuberculosis have overlooked.

Problems of another nature arise when we attempt the tuberculosis education of graduates, who are usually general practitioners. We have long been aware that many of these men were clamoring for a better appreciation of our most common affliction; in response to an insistent demand it has become fashionable to organize schools for "intensive" instruction of tuberculosis. These schools pretend or essay to range the field at large, and in six weeks at the longest place before the student the totality of our knowledge of tuberculosis. Tuberculosis in children is covered in an hour or two, while the larynx, the bones and joints, the genitourinary system, the meninges, the peritoneum and intestines, receive as much or less attention. One morning will generally "clean up" the bacteriology of the bacillus, and another morning the pathological reactions to the bacillus. There are demonstrations and drills on signs and symptoms with fleeting interludes of institutional management and the social phases of tuberculosis. The paper plan of some of these courses is almost a transcription of the table of contents of Cornet's book, and if anything is missed I have failed to detect its absence. All this in six short weeks and less!

I would be the last to dispute that in experience and judgment the man who has practised medicine has a very definite advantage in assimilating knowledge over the immature undergraduate. Yet I consider it arguable whether this advantage may not be offset by the enthusiasm, the plasticity and the quickness of perception which are more common to younger minds. And I seriously question whether this cramming process of "intensive" instruction of graduate schools is serving the best interests of either student or education in tuberculosis. A student with a fair knowledge of tuberculosis can no doubt profit much by the course and have his ideas orientated and crystallized. But the student without such preliminary knowledge — and he is one of the majority who take these courses — must run the danger of stepping from the crystalline atmosphere of ignorance to a murky one of intellectual fog. I had rather see the average graduate student put on one case and on one sputum and one cadaver or pathological specimen and one infected guinea pig and one culture until, with his instructor, he had exhausted the possibilities of

each, than continually transferred from one sketchily presented subject to another. I believe that this method would turn out wiser and more effective men. It might look less showy in the prospectus and appear less popular to those unfit and unprepared practitioners who were accustomed to *gaze upon* the wealth of Vienna clinics: but effectiveness in education must be estimated, not by the mass that is presented to the intelligence, but by the growth which the intelligence has assumed.

Four years ago I spoke at an annual meeting of this Association on Undergraduate Instruction in Tuberculosis. Before leaving for Cincinnati I read my address to Dr. Theodore Janeway, a man of broad experience and vision. I was in the midst of reciting apparently essential details for the proper training of medical students, and among other necessities came upon the phrase "an able and enthusiastic teaching force"; when Janeway interrupted with, "Ah, that is the heart of the whole problem. Where and how are we going to get the able and enthusiastic teachers?"

Since then my time has been continually and exclusively occupied with tuberculosis work, much of which has had to do with the education of students, both undergraduate and graduate, and of the public. Perhaps no part of it has been so beset with what seem to me unsolved difficulties and problems as this one of education. And in reflecting upon them I usually find myself coming back to Janeway's query, "how and where are we going to get able and enthusiastic teachers?" To me "able and enthusiastic teachers" mean men who before they essay to teach are thoroughly grounded in tuberculosis; men, also, who are making of it their life study; men, capable of conducting investigations, and with the time at their command to do so.

Our potential sources of tuberculosis teachers would seem to be the medical schools, the sanatoria and the small body of practising and consulting physicians who are making of tuberculosis — usually pulmonary tuberculosis — a specialty. To the uninitiated it might seem a simple matter to call upon men from all three sources and put them to work at teaching tuberculosis. But a very incomplete survey of conditions as they exist at present will at once bring to light many handicaps which would hobble any efforts to build up a strong body of men who are to devote their lives to the teaching and scientific pursuit of tuberculosis, both of which occupations are, in my mind, inseparable requisites for advancing our subject.

So far as medical students are concerned, you will no doubt grant that their instruction must proceed in the medical school or under its auspices. Our newer and more solid ideas of infection, immunity, symptomatology, diagnosis, latency and activity, therapy, etc., point out with increasing emphasis that tuberculosis is a subject which comprises vastly more than the diagnosis of its pulmonary phases and the treatment of special classes of these. Only in medical schools connected with large general hospitals can we expect to come in touch, even approximately, with tuberculosis as a whole. The function and the opportunities for observation in

almost all sanatoria are, after all, very limited and very special. Almost all their inmates are referred patients, with diagnosis already made, and represent usually a few selected more chronic types of disease. A man may spend a lifetime at a sanatorium, be looked upon as an expert in tuberculosis, and yet never called upon to make what is now and again the most difficult of diagnoses, namely, that of acute tuberculous pneumonia or miliary tuberculosis in a previously healthy adult. Yet this is the common contact of the general hospital ward with pulmonary tuberculosis, and brings into play diagnostic qualifications which the *average* sanatorium resident has not had the opportunity to acquire.

The x-ray department of a large general hospital will make observations on as many as twenty thousand plates a year, depicting every variety of pathological abnormality occurring at every age. It is to be expected that the same man will gain a much broader and a more exact idea of the roentgenology of tuberculosis in a general hospital than in a sanatorium: and the fact that in the former his impressions will quite often be tested by an autopsy will contribute to his poise and carefulness of interpretation.

The question of tuberculosis as against other affections comes up daily in the children's clinic, and now and then you will be fortunate enough to observe the clinical disease develop under your eye in children whom you had previously had under observation for measles, pneumonia, etc. The masked phases of tuberculosis, as they present themselves to the dermatologist and ophthalmologist, call for thorough investigation from the point of view of foci elsewhere in the body. More marked manifestations, which come to the attention of the orthopedist, the urologist and the general surgeon, present the same opportunity. The tuberculosis dispensary has its own unique problems of diagnosis and treatment; while the hospital pathologist will show you tuberculosis where it was never suspected during life and no tuberculosis where you had positively proclaimed its presence.

Now, with all these opportunities to study and teach tuberculosis as a whole — and this is the only truly effective way to handle the subject — there is not a single medical school or university in this country which has shown itself fully alive to the possibilities of developing the scientific side of tuberculosis. There is not even a single adequate, *permanent* foundation in tuberculosis. The result is that there is no inducement for the better class of men to go in for a career in tuberculosis, with the further result that we can develop few able teachers in the subject.

What attracts eager, young minds with a passion for study and investigation to enter upon a scientific medical career? It is, besides the facilities and opportunity for work, the possibility of ultimately attaining a position of dignity and influence in their chosen work. This is, and always will be, the incentive: the opportunity to make money, to "cash in," will always be subsidiary and when it comes and is grasped, it usually plays havoc with a man's usefulness as an investigator. Without the incentive I have mentioned we can look forward to but little advance in

real tuberculosis education; for we will not be in the position to train teachers of the same grade, say, as those who now occupy our chairs of medicine, surgery, pediatrics, etc.

Let me put the case a little more pointedly. I direct a department in tuberculosis. Its primary object is research. In it is also a dispensary, and it teaches students by clinics, lectures and first hand demonstrations of patients. It has, moreover, desk facilities for the laboratory training of a few students.

Now, suppose a man comes to me, fired with the idea of devoting his life to the study of tuberculosis. He wishes to train under me. What, in all honesty, am I to tell him? Why, I must talk to him something as follows: "You are welcome to every facility that is here and I shall give you every aid. But I really don't know what to do with you if you make good, if you gain a mastery of your subject and show talent for furthering it. On the other hand, I don't want you if you are going to fail; and if I knew or thought that you will fail, I should not take you. Yet, if you do make good, where is there a position for you? If you should go into medicine or surgery or gynecology or pathology or any one of a dozen other branches, there are a full score of decent professorships in each, any one of which may in time come to you, provided you play the game and make the most of your abilities and opportunities. Now, I have watched you and have thought that you may have a special talent for tuberculosis work; yet at present I really can't see what's ahead for you except my own job and it is not on any too secure a basis."

I have made this kind of a speech, not once, but several times within the last few years: and I have made it with a gripping at the heart. I have turned men away, have seen them lost to tuberculosis, simply because I could not see ahead of them an adequate career in tuberculosis. Almost any other branch of medicine was open to a display of their talent — but not tuberculosis. And remember, please, that I am in a peculiarly favored position.

This situation would change over-night if we had foundations — departments of tuberculosis — in our medical schools: it will not change until we do have them. I should say that in medical schools like Columbia, Harvard, Pennsylvania, Chicago, Johns Hopkins, etc., an adequate foundation would require resources netting $50,000 a year.

This is, indeed, the very heart of the problem of tuberculosis education. With permanent tuberculosis foundations, investigators and teachers would soon spring up. Many would come over from pathology, bacteriology and clinical medicine. Many scattered phases of tuberculosis in general hospitals would be coördinated and harmonized. Above all, students would be taught tuberculosis as a whole. It surely should not be necessary for me to detail what all this would mean to tuberculosis. Suffice it, that tuberculosis would take its place as a branch of medicine, acknowledgedly on a scientific basis.

If we go to the sanatoria for our teaching and inspiration, what do we

find? In trying to answer the question I wish to be particularly honest and fair, and trust that I may not be too lavish in either praise or censure.

As I see it, there are invested tens of millions, supporting hundreds of institutions, taking care of thousands of patients who offer a most fruitful field for the study of tuberculosis which is hardly cultivated. The apparent apathy and lack of interest manifested by the medical staffs of sanatoria in the study and investigation of tuberculosis must be the despair of the well-wisher for tuberculosis. Here are hundreds of men, surrounded by a wealth of clinical material, yet real study of it is so uncommon that a sanatorium resident who publishes a paper now and then, at once and because of the fact, is regarded as an unusual man.

I have asked many why this lack of initiative and investigative morale exists in the sanatoria; and have received various answers. Some men tell me that the present organization of the average sanatorium and the duties of its medical staff leave little time for study and thought. If this is true, then the quicker we bring it about that the resident physicians are relieved of the responsibilities of business managers and stewards the better it will be for institutions, for patients and for tuberculosis.

Others tell me that the very location of many sanatoria and the usual method of recruiting their medical staffs work against the development of lively and active interests in study and discovery. For very good and sufficient reasons, sanatoria are frequently placed in isolated places. Their medical staffs are thus cut off from that close association with their confrères which is so stimulating and so necessary, if intellectual stagnation is to be avoided.

Again — so they say — many, many sanatorium men are physically weak and medically weak. To be physically weak, within certain limits, does not necessarily mean that a man cannot do good work; it does not mean so, if within him there burns the passion to develop those talents of mind and soul which physical weakness quite often gives unusual chances for exercise. Somewhere in one of George Gissing's essays, there is a phrase that runs something like this: *that the man of thought is almost of necessity a man of impaired health.* And our own Trudeau, or Kant, or Florence Nightingale, or Walter Scott, or Charles Darwin, or a host of thousands of others of the world's great in all ages, bear witness to the eternal truth of Gissing's statement.

I am not so sure that a general indictment of "medical weakness" against our sanatorium staffs could be sustained. Nevertheless, it is noticeable that many of our residents, before taking sanatorium positions, have had no more training in general medicine than that afforded by an undergraduate course, and that frequently this has been interrupted because of illness. Personally, I think that, if too many men of so little preliminary training hold posts of responsibility in sanatoria, it cannot be otherwise than bad for tuberculosis. There are, of course, exceptional men who will come through despite every handicap and deficiency of background; but, as a general thing, I am inclined to question seriously the voice of authority in tuberculosis which has assumed eloquence be-

cause of a superstructure of sanatorium experience on a cornerstone of an ordinary or crippled medical course. Too exclusive an attention to pulmonary tuberculosis with little or no acquaintance with general medicine is bound to give us a false tuberculosis; which might be worse than the ignorance of tuberculosis that would mark the general practitioner who shuts his eyes to tuberculosis as a phenomenon to be reckoned with.

Wherever the trouble may lie, the fact remains that too little study is going on in our sanatoria and too little solid work is coming from them. And if anyone were to ask me how the situation might be bettered, my instinctive reply — and I hope Lawrason Brown will pardon me and allow me to make it — would be, "Go see Lawrason Brown." For I consider that in ten years of residence at the Adirondack Cottage Sanitarium, under conditions which I know were not always rosy or ideal, Brown demonstrated what can be done with sanatoria as centers of investigation and development of tuberculosis. Further, I cannot see why Brown's example in this respect cannot be followed in scores of institutions throughout the country, yet the list of sanatorium men who have attempted to use their institutions as places for *sustained* and productive study is lamentably small.

A man who is not interested in study is not a fit teacher; or, if this statement is too extreme for you, then a born teacher, who develops tastes for study and investigation, becomes an infinitely better teacher. Teaching consists in something vastly more than unbosoming your knowledge to the student. It demands that you have within you that interest and passion in your subject which will inspire your student and goad him on to self-development: and this interest and passion can be kept alive only by study and investigation.

Such then, sketchily and imperfectly presented, is the situation as I see it. I have tried to go to the root of things and discuss what appear to me as fundamentals. This has no doubt made me censorius, and indulge a spirit which is furthest from my intention. Let me remind you, though, that my own life's work is wrapped up in this matter of tuberculosis instruction, that I have tasted of its possibilities, that I too am beset with difficulties which are far from solution, and that I am trying to find a way out.

The sum and substance of my own views of present problems of tuberculosis education are that (1) we should not expect too much from instructing undergraduates because of the great diversity of topics which now occupy their time, nor should we lay too much stress on physical diagnosis in particular, since an expertness in this cannot be acquired from facilities now open to students; (2) short courses for the common run of graduate students require great simplification, elementary thoroughness and concentration on several — perhaps a very few — particular objects; (3) the heart of the problem is the building up of a body of able teachers, and (4) it is doubtful whether, with relatively few

exceptions, able teachers in tuberculosis can be recruited from either medical schools or sanatoria under existing conditions.

If you ask me for solutions, then I would reply that I have none ready. Yet I believe that with definite objectives before us of what we wish to correct and achieve, with no illusions as to the time or trouble that it is going to take us to achieve our purposes, and, ever hopeful and thick-skinned against discouragement, with a long and strong pull working all together, we can work out satisfactory arrangements and send tuberculosis far.

We should at once begin to take measures to plan departments of tuberculosis in medical schools and to raise requirements for medical internship in sanatoria and standardize sanatorium management, the last object of which means that a medical director should be engaged with medical matters and with nothing else.

We should decidedly get more general medicine into sanatoria and more tuberculosis into general medical schools. I can see nothing to prevent working arrangements for fortunately situated institutions, whereby sanatorium residents may spend part of their time in general hospitals while hospital residents and medical students similarly put in a month or several months a year at sanatoria and whereby the several institutions may exchange teachers and laboratory workers.

I have rather grandiose visions of the possibilities of sanatoria in education, just as soon as the morale of their staffs is uplifted and tightened all around and their functions are broadened as I have attempted to point out. I hope to see them centers of investigation and of solid instruction in tuberculosis to physicians roundabout. The time is almost ripe for sympathetic bodies like the American Sanatorium Association and the National Tuberculosis Association to undertake an exhaustive and constructive inquiry into how the scope of tuberculosis sanatoria may be broadened and improved, especially from the point of view of education and scientific activity; for, with the millions invested by the people in sanatoria and in the face of a growing murmur that sanatorial functions are very limited and that the institutions are not giving results proportionate to value received, it is inevitable that if we do not make the survey, if we do not take hold of the reconstruction, less charitable interests will demand the right to do so.

And, as a parting observation, I would point out that tuberculosis, as an attractive and interesting field for study and training, will appeal to physicians and students alike, in a measure that is directly proportional to the devotion to study and productiveness in investigation which those at any time identified with tuberculosis exhibit. The animal man, the general public, is just so "cussedly" constituted that the business of resting on one's oars will not excite him: he delights in and is enthused and motivated by action. The moment a reputation becomes static, that moment it enters upon its descent to obscurity: growth comes only through feeding and strength through exercise.

DISCUSSION ON PAPERS BY DR. KLOTZ, DR. BALDWIN AND DR. KRAUSE

Dr. Edward O. Otis, Boston: I am quite conscious that I have much to learn in teaching medical students the elements of pulmonary tuberculosis, but in an experience of twenty years I have learned a few things and arrived at certain convictions.

In the first place, as most of the clinical teaching is confined to the last two years in medical school, but very limited time can be devoted to any one special subject and we now regard pulmonary tuberculosis as a special subject. Therefore, we have to make the most of the limited time at our disposal and this I believe can be best done by clinical teaching in small sections. I do not believe the purely didactic lecture is of any great value, provided the clinical teachers are competent. Sections of seven students are large enough and sessions of two hours are to be preferred.

In regard to the clinics, I am convinced from my experience that the dispensary is the best method of using clinical material in the teaching of tuberculosis. In the sanatorium or consumptive hospital, and I have used both, the diagnosis is, for the most part, already made and the disease more or less advanced. In the dispensary, on the other hand, one has a new problem to solve, which can be made a very fascinating one, and consequently one can excite the interest of the student far more, by this new problem, in determining whether or not this or that symptom for which the patient comes to the dispensary, suggests or means tuberculosis. As I tell my students, it is a Sherlock Holmes hunt for the criminal from the clues at hand.

Of course, if time permitted, additional clinics in sanatoria and consumptive hospitals add much to the value and completeness of the course. Again, in taking students at the beginning of the third year, when they are supposed to have had a previous course in general physical diagnosis, one often finds, however, that they really have but little working knowledge of this subject, and consequently the subject of physical diagnosis, as regards the chest, has to be constantly reviewed. For example, I often find a student who is unable to discriminate between vesicular and bronchial respiration, so that inevitably, considerable time has to be devoted to the establishment of primary standards from which to work.

All one can expect to accomplish in such a limited course is to enable the students to recognize the plainly evident physical signs and the significance of the symptoms.

One finds also that students are not infrequently defective in logical reasoning. They often fail in their ability to correlate signs and symptoms and in drawing logical conclusions from the sum complex.

From the limited amount of clinical instruction in pulmonary tuberculosis, we ought not to expect the student on his graduation to be proficient in the diagnosis of tuberculosis. I have had occasion, however, to observe the results of this limited amount of teaching as I have met my

former students from time to time in consultation. They may not be able to make an early diagnosis but at least they seem to be able to suspect tuberculosis if they detect certain signs and symptoms and refer the case for further examination.

In general internal medicine, besides two years of clinical instruction in the medical school, an interneship of one or two years is considered almost obligatory before the graduate is considered competent to practice medicine — and yet we expect him to make an early diagnosis of tuberculosis with so little clinical experience and no interneship. I am convinced that interneship in sanatoria and consumptive hospitals should be made available for recently graduated medical students and that such positions should be made so attractive through competent personnel, that they will appear desirable. Moreover, such internes should receive a reasonable honorarium (as is done now in many hospitals). Finally, the dispensary used for teaching purposes should have proper equipment — a good laboratory and a good x-ray department. Thus equipped and with an enthusiastic teacher, I believe it is by far the best place to teach clinically pulmonary tuberculosis.

Dr. **Kennon Dunham, Cincinnati:** The papers that Dr. Baldwin and Dr. Krause presented substantiate beyond any question of a doubt that we need two great things in education in tuberculosis. We must have the postgraduate training and we must have research work put upon a firm foundation by having good foundations upon which they can stand. As Dr. Krause has said, if there is no place of dignity for these men to work after they have taken their special training, we cannot expect people to continue to make a sacrifice for tuberculosis. The necessity of education means the necessity of our going out and working for foundations. Every one of us connected with hospitals or medical colleges should, above everything else, try to secure research foundations, so far as that is possible.

I have heard no mention of the big advance that has been made in the last few years, thanks to the war, in medical education. To Colonel Bushnell, I believe we owe a tremendous debt of gratitude. He has focused clearly upon the minds not only of our group and of the medical profession, but even upon the minds of the laity, most of whom had relatives, or at least friends in the service, the necessity of good physical examination. He has shown us a simple method of approaching this subject, has shown how good, sound physical diagnoses can be made, and that a diagnostician can be made out of an ordinary doctor without any great amount of time being spent on it. Then, when Dr. F. C. Smith took charge of the tuberculosis section of the Public Health Service and summed up the great work done in the Army, we saw an opportunity to carry home the work that had been started.

And now, as to our own medical colleges, don't let us be discouraged by these papers, don't let us feel that this subject of education cannot be conquered. The fundamental thing about surmounting physical diagnosis is first to interest your boys in physical signs, especially of per-

cussion and auscultation as found in the physical chest. If we had waited until the third year class came to us before letting them get their physical diagnosis, as we did formerly, we would not have gotten very far, but, thanks to this rejuvenation of medical interest in teaching tuberculosis or physical examination of the chest, we have really accomplished some good results. I am thinking especially now that if you will go back to those men teaching normal physical diagnosis and not ask for an extra hour, but ask that they limit the time given to chest examination to teaching those boys signs of the normal chest, you will be able to carry one point a little farther, putting into our medical schools just what Colonel Bushnell tried so hard to put into us doctors in the Army.

If the student is once thoroughly grounded in knowing the normal chest, in knowing where normal bone is, where normal loss of resonance can be found, how the breath sounds change over the chest, and that marginal râles are heard in the tuberculous chest, and if he comes to know what those sounds mean, what inspiration or expiration is, then he is interested to know what is inside of that. Then is the time to open your x-ray picture up to him. Don't stop there. That leads him to what? To a knowledge that he wants to get, to the pathology. He wants to get over then to the postmortem school. Those students, after all, are most vitally interested to find out, as the result of the autopsy, whether their diagnosis was correct or not. You have then accomplished the first thing in order to get this education to the student, that is, you have aroused the student's interest.

Col. George E. Bushnell, Bedford, Mass.: I may be permitted, perhaps, to thank Dr. Dunham for his very kind remarks, and I may say also that he has taken a good deal of my thunder.

However, I wanted to emphasize one phase of the subject of medical education as it relates to tuberculosis. I do not agree with the speakers who have said that tuberculosis should be considered a specialty. I think if we make tuberculosis a specialty in instruction we are tending to keep it too much to ourselves as tuberculosis specialists. I do not believe that the tuberculosis problem will ever be settled until the family practitioner can diagnose tuberculosis. You can never expect to do what should be done by medicine until the rank and file in the profession can diagnose tuberculosis; and I do not myself consider that tuberculosis diagnosis is so particularly difficult that there should be any reason why knowledge could not be imparted so that a fairly good diagnosis can be made; so that the family practitioner can determine the existence of the disease or can suspect it and can give the early treatment and the proper advice which is so often not given.

The point I want especially to make is this: That the study of diagnosis is based upon a study of technique. You try to teach the medical student by instruction, either imparting information or by illustration, and you haven't made a beginning. Every medical man, no matter what his specialty may be, has to appreciate fine distinctions of some kind; he has

to have a training of his senses. There is nothing like physical diagnosis to teach a man to appreciate the fine distinctions of sound, of touch, the fine graduations of percussion, and I believe personally that the teaching of physical diagnosis is one of the best preparations of the medical man for his career, whatever it may be.

If you were going to teach a man carpentry and you said, "Here is a saw and a chisel and a plane; they are used so and so. Now you can saw one board, you can make one tenon and mortise, and you can smooth one board with the plane; then we will go on and study advanced house construction," that would be a parallel case to what the instruction generally is in physical diagnosis. A man hears a few râles, he thumps a few chests, and then he hears a lot of things that have no bearing upon the subject. The result is that he goes away from the medical school without any definite knowledge as to what he can do, without having an understanding of what he has done, without having had his capacities tested.

Before the war we started a course in physical diagnosis, to find out what the men could be used for. I was astonished to find out how popular that course became. Every man who took that course was pleased with it, and the popularity increased to such an extent that we had to multiply the course; altogether we taught over 2,000 physicians. Why was it so popular?

Because the instructor gave close attention to each student, showed him how to fit a stethoscope to his ears and how to use it and continued his instruction until the student had learned to hear and to distinguish sounds. Many were greatly pleased to find that they possessed the faculty of judging properly the sounds where they heard and a good deal of unsuspected ability was revealed.

The close personal touch with the instructor enables the pupil to appreciate the correctness of his observations and of the deductions which he makes from those observations. If the pupil has anything in him this method will bring it out. Only very rarely were men found who could not or would not learn.

The way to learn physical diagnosis practically, I take it, is to study the normal chest, and I am glad Dr. Dunham said what he did about that because there is a wealth of material going to waste. A man who can tell you accurately everything there is in the normal chest in the way of variation of breath sounds, in the way of percussion sounds, knows diagnosis enough so that he can go on by himself. As far as the acquirement of technique is concerned, you acquire technique only by actual practice.

If you have to examine a man who is sick, you have to spare him; you should spare him. However, you either hurt the patient or you don't get enough practice. On the other hand, you can take the healthiest man that ever lived and work a number of days on his chest and there is no doubt but that you can learn something every day that is worth while.

That great man, Dr. Bowditch, says in his work, "The Young Stethoscopist," published in the middle of the nineteenth century, that any man who wants to learn diagnosis of the chest should study three healthy sub-

jects a day for three months and then he will begin to know what the normal phenomena of auscultation are. Dr. Bowditch is the only man that ever lived, so far as I know, that has given advice of that kind.

Dr. Charles L. Minor, Asheville, N. C.: There are two aspects of this question which has just been propounded. We have the question of instruction of the medical student. It would be most unfortunate if we were trying to turn out specialists from the medical schools. If those men could go right from the medical school into a sanatorium, you know what poor men they would make, having had no chance to learn at the bedside general internal medicine. Therefore, I think there is an excellent opportunity for Dr. Klotz' work in teaching tuberculosis in a careful and thorough way to men who are going out to practice general medicine.

Does that say that there is no need for Dr. Baldwin's work at Saranac? Not at all. When a man has practiced for a certain length of time, has run upon cases of pulmonary tuberculosis, and found difficulties which a careful course in medical school has not fitted him to meet, then he can go to such a tuberculosis school wisely. Those are the men who ought to go into our sanatoria.

We need, therefore, both kinds of instruction: the instruction in the medical school for the purposes of making broadminded doctors of general medicine; that in the special tuberculosis school to prepare men who have found their life interest, who have found that this is the thing that appeals to them to go into as specialists or possibly as research workers — at least, to become good, careful clinicians in the line of tuberculosis.

Dr. E. S. Mariette, Hopkins, Minn.: I want to report what we are doing at Glen Lake Sanatorium in conjunction with the Minnesota Medical School. We receive nurses for two months each on a rotating service with the University Hospital. This is to be extended to other hospitals in Minneapolis as soon as we are ready to care for the student nurses.

The junior class is divided into small groups of from six to ten each and each student spends 16 hours at the sanatorium in bedside instructions.

The senior students spend ten weeks at the sanatorium as student or junior internes on a rotating service with the University Hospital.

The work has proved so valuable that the graduate internes at the University Hospital unanimously requested that Glen Lake be put on their rotating service. This has been done and they spend five weeks at the sanatorium as senior or graduate internes.

Dr. Elmer H. Funk, Philadelphia: My experience and interest concern largely the undergraduate teaching of tuberculosis. Reference was made in several of the papers to the casual interest displayed by teachers of medicine and the crowded medical curriculum. When I was graduated over thirteen years ago that casual interest was evident, and although the medical curriculum was not crowded we learned very little of tuberculosis. I think that this was pretty generally true of medical students at that time. The present day students with the interested teachers of

medicine have an opportunity to learn infinitely more than we did, and that in spite of the crowded curriculum of to-day.

To illustrate how this change came about in one medical school, let me tell you of our experience at Jefferson. Shortly after Dr. Thomas McCrae became professor of medicine it was realized that increased facilities were necessary for the adequate teaching of tuberculosis. The college acquired in 1913 by purchase, buildings which afforded the facilities for the bed care of forty patients with tuberculosis, with ample room for dispensary and social service departments. This separate teaching unit afforded a special opportunity for students. They are assigned to this department in their junior year, after having had a thorough grounding in the examination of normal chests in their second year. The teaching of tuberculosis in this way allows not only of instruction in the specific problems of the disease, but of the physical diagnostic methods referable to the chest in general. These same students return in their senior year for additional instruction along advanced lines. They spend forty hours in the tuberculosis department during the junior year and twelve hours in their senior year. One of our guiding principles in instruction is that to which Dr. Krause has referred in his paper, namely, that one case well demonstrated by the teacher and well studied by the student, is better than many cases hastily gone over, and I would add that when it is possible to take the student to the post mortem table, the clinical lesson is impressed in a way that is not otherwise possible. Much of the thoroughness of the tuberculosis teaching in a given medical school must depend also upon the enthusiasm and interest of those outside of the medical division — the pathological department, the bacteriological department, the surgical division, etc., etc., must needs teach it as well as the medical department if sound knowledge of the disease is to be inculcated in the undergraduate's mind.

Finally, with regard to securing from the curriculum committee an adequate amount of time for the subject, I would state that one's best argument is that tuberculosis well taught is medicine well taught. The principles and practice of medicine in general are elucidated in a remarkable way with tuberculosis as the student's text.

Dr. F. C. Smith, Washington, D. C.: I think the trouble is that the subject of tuberculosis has been kicked upstairs. There are at the present time only three medical schools in the United States that have a professorship in tuberculosis but practically every medical school in the United States has seven professorships in surgery alone. Counting general surgery, orthopedics, gynecology, obstetrics, genito-urinary surgery, and surgery of the eye and ear respectively, we find that the surgeons have seven professorships and we haven't any. We can't, however, blame anybody but ourselves, because we consented to have tuberculosis classed as a specialty, for special hospitals in special climates. We isolated the subject from general medicine almost as dentistry was isolated.

Now, we realize that we were wrong, that tuberculosis isn't such an

exclusive specialty after all, and that we must bring the subject in from the desert and mountains and teach the general practitioner what tuberculosis is. The good old family doctor at the present time, when he makes a diagnosis of tuberculosis, is a very distressed man. He says in effect, "You have tuberculosis; a change of climate is what you need. Go to New Mexico or any place you want to go to, but get out of my way and don't bother me."

When we come to the medical schools and ask them to teach tuberculosis as it should be taught, we find them much harassed and the curricula filled. If, thirty years ago, we had claimed the same share of the curriculum that the surgeons did, the family doctor would now know tuberculosis, and there would be a man in every cross-roads town with a knowledge of tuberculosis equal to his interest in surgery. Doubtless the medical schools will eventually give the subject its proper place, even though it becomes necessary, after the second year, to divide the medical schools into Colleges of Surgery and Colleges of Medicine respectively.

Dr. L. J. Moorman, Oklahoma City, Okla.: In view of the fact that the attitude of the general hospital toward the admission and the care of tuberculosis cases has stood materially in the way of progress in connection with the education in tuberculosis, I think in connection with this symposium it is significant that the House of Delegates at the recent meeting of the American Medical Association passed a resolution recommending that hospitals admit tuberculous cases either in special wards or in the general wards of the hospitals, and I believe Dr. Smith deserves a great deal of credit for that.

Even though we have available sanatorium material, as has been pointed out, comparative x-ray studies and differential diagnosis can better be carried on in general hospitals.

In closing, I want to ask Dr. Klotz one or two questions. I would like to ask how much time is given in the junior year to this work and what part of it is didactic? Where does the study of the normal body come — in the sophomore or junior year, and how much time is given to that? I would like to know also what the capacity of his sanatorium is?

Dr. Klotz: I will answer these questions first. In the junior year, — that is the third year — fifty hours of practical work. There are no didactic lectures, but there are informal conferences and discussions and the abstracts of papers that were referred to. That is part of the time.

The normal physical diagnosis is supposed to have been taken up before the end of the second year, and students are supposed to come prepared with this knowledge of physical diagnosis, but I want to be frank and say that they do not.

The capacity of the sanatorium is 120 beds.

On account of the lateness of the hour, I don't want to take up any more time. There are a number of questions that we might debate and discuss for an indefiinite length of time. There is one thing, however, that I do want to say and that is that the man who knows how to diagnose pulmonary tuberculosis isn't injuring his knowledge of physical diagnosis in general.

NOTES UPON THE SURGICAL TREATMENT OF CERTAIN CASES OF PULMONARY TUBERCULOSIS

By Edward Archibald, M.D.

Montreal

America is not generally supposed to be arrière in matters surgical, nor is she; yet it is somewhat strange that in this country the surgical treatment of certain types of pulmonary tuberculosis should have remained so far behind the standard set for some years back in Europe. It is indubitable, says Sauerbruch in a recent article, that surgery can cure a certain proportion of certain types of tuberculosis which are not otherwise subject to improvement by our ordinary methods of treatment. That this fact remains unknown to the generality of the profession in this country is, I think, fairly sure, and that it remains still insufficiently appreciated even among the members of this Association is also, I think, probable. The general profession is still largely ignorant of what a considerable measure of benefit can be accomplished by artificial pneumothorax. The members of this Association know that, but when it comes to surgical attainment of the same object by rib resection our members are, I fear, insufficiently alive to the possibilities. Extra pleural thoracoplasty is an operation that has come to stay. It has already proved its right of citizenship in Europe and is now beginning to become known in this country. I have heard of an odd case here and there being done in this country, but certainly very few so far have been reported. Willy Meyer's case report in a number of *Surgery, Gynecology and Obstetrics* about a year ago is the only proper report in American literature that I have so far seen.

My own experience covers a total of eleven rib resections for pulmonary tuberculosis: two rib resections for abscess of the lung; one for lower lobe bronchiectasis; one resection of the phrenic nerve in a case of unilateral, chiefly lower lobe, tuberculosis; and one cutting of adhesions in the upper pleural space, in order to allow complete pneumothorax.

I thought it might interest the members if I set down the lessons I have learned from this experience. No matter how much one studies the work of others one has to get one's own experience: and as we have to work together, surgeon and internist, particularly in the matter of selecting the type of case that promises benefit from operation, I thought we might profit most if I analyzed the unsuccessful and the fatal cases first and foremost. Excluding as not belonging strictly to the subject the rib resections for lung abscess and bronchiectasis and the phrenic-

otomy, there remain a total of twenty-three operations in twelve patients. Of this series three died. These three fatal cases I may now report briefly.

Case I. Mrs. K.— This patient was a woman of thirty-five years of age, referred by Dr. Lawrason Brown, of Saranac Lake, in 1913. She had been sick for nine or ten years. She showed an extensive unilateral lesion, with cavities in the upper lobe. She had run a fever for months and was hectic, altogether a poor subject. At that time, or shortly before, Friedrich had published results under his method of total extrapleural thoracoplasty, by which he meant a removal of all ribs from the first to the tenth, and in their whole extent from front to back. This had been done by him even in one stage, but he suggested that it would be safer to do it in two stages. His results showed a mortality of something like 25 to 28 per cent. As, however, his good results were exceptionally good, and as the method derived great authority from his name, I judged that it might be risked in this particular case, if the procedure were carried out in two stages. Very shortly before Wilms had published his method of columnar resection, which, however, was based on a very few cases insufficiently observed, and it did not seem as if his method promised sufficient benefit for the trouble and risk involved. Accordingly I removed at a first stage the lower ribs from the tenth to the sixth in the greater part of their extent. The immediate results were quite encouraging. Sputum was diminished and her fever subsided, and altogether the matter seemed promising. About ten days or two weeks later I proceeded to remove the upper ribs in their whole extent. This operation was immediately followed by very marked shock, and an extreme degree of paradoxical breathing. The operation was done under positive pressure and it was immediately found after the operation that the removal of the positive pressure led to very threatening symptoms of immediate death, so that for an hour or two positive pressure had to be kept up in the conscious patient. She then recovered somewhat of her balance but remained very dyspnoeic with strong indrawing of the chest wall during inspiration and bulging out on expiration. This paradoxical respiration with the fluttering of the mediastinum persisting through the next few days could not fail to weaken the heart, so that on the sixth day the heart ultimately failed, pulmonary oedema supervened, and in spite of oxygen inhalations under pressure she ultimately died. We all know that an artificial pneumothorax too suddenly induced may easily produce the same ill effect. The fatal result in this case was obviously one that should not occur nowadays. It was a mistake in judgment, a mistake that should be put in the class of pioneer errors. Too extensive operations have now for years been abandoned, and no patient at present should die from this cause.

The earlier surgeons who worked in this field, Spengler, Turban, Baer, removed too few ribs and over too small an extent so their results were far from encouraging. Friedrich, on the other hand, removed too great an extent of rib. His mortality was much too great. We have

now learned, owing to Wilms and Sauerbruch, to strike the happy mean. We know fairly well how many ribs and how large a proportion of each one can be resected with safety.

Case II. A second fatal case was referred to me by Dr. Pratt, of Boston, in 1914. This patient was a man of nearly fifty years of age, who had been ill for twenty years with unilateral pulmonary tuberculosis. He had large cavities, was hectic, weak and showed the evidence of chronic blood infection. I had grave doubts about the advisability of attempting the operation in this case. Still it seemed possible, and having realized the folly of taking away too large an extent of rib, I felt that a smaller removal could be safely performed. At a first stage I removed portions of the tenth to the sixth ribs. In three days he died from an acute fulminating streptococcus infection, and post mortem showed that under the scapula there had formed a small abscess containing virulent haemolytic streptococci in pus which measured only about two or three drachms. Being covered over by the scapula it gave no signs on the surface, and it was impossible to diagnose the condition. Otherwise it might have been opened and the patient possibly saved. Dr. Pratt was so kind as to suggest that the various exploratory punctures, which he had made in attempts to induce an artificial pneumothorax, some fifteen punctures in all, had led streptococci from the lung tissue out into the muscles, and that the streptococci had been roused to activity by operation. Whether this was so or not it is, of course, impossible to say. In any case the fatal result must be ascribed to imperfect technique of some sort. In a patient who has been so long ill with chronic fever it is probable that we must always fear a possible blood infection, and in such cases it would be wise in the future to make blood cultures before operation. However discouraging the incidence of wound infection may be it can not of itself restrain surgery in its efforts to relieve pulmonary tuberculosis. Otherwise nothing could be done. Such a complication, fortunately, to judge from the published records of operations, is to be feared very infrequently. I find no other instance in my own experience, nor in that of Sauerbruch.

At this point the war intervened and this work was discontinued. Upon my return, during 1917, the work was again taken up and we have then a series of good results, which I shall not here set down in any detail. But last year there occurred the third fatal case, which I shall now report.

Case III. This patient was referred to me in September 1920 by Dr. Pottenger, of Monrovia, California: and inasmuch as the case was treated after a wider experience than was available for the two earlier ones, and the fatal result, therefore, was the more to be criticized, I propose to relate the history in greater detail, in order that the lesson may be thoroughly conned.

Mrs. McN. Age 38. Admitted to the Royal Victoria Hospital September 29, 1920. The patient had been suffering from recognized pulmonary tuberculosis for eleven years, most of which time had been

spent in sanatoria in the Southwest. The process had affected the left side chiefly, although there was also slight disease in the right apex and the bottom of the right lower lobe. In July 1920 she had what was probably an acute pleurisy of the right side, with fever up to 103, an increase of sputum from sixty to about 130 c.c. and aggravation of the cough. During this illness, which lasted two weeks, she lost thirteen pounds, but recovered well during the summer.

Her condition on admission was as follows: General weight and strength fairly good. Apart from the pulmonary condition there is nothing worthy of note. On the left side the disease involves the whole lung from top to bottom, and a series of small cavities, both in the upper lobe and in the lower one, are obvious both in physical examination and in the x-ray picture. This has been accompained by an extraordinary degree of fibrosis. Dr. Pottenger pointed out in a letter the extreme degree of compensation in this case. "The amount of compensation in her chest (he writes) is the greatest of any that I have ever witnessed." The left rib spaces are greatly narrowed; the heart pulled up, far outwards, and to the back; the diaphragm is very high; the supraclavicular space fallen in. The right lung, on physical examination, showed only compensatory emphysema, but in the x-ray picture there can be seen a slight apical lesion and also at the bottom of the lower lobe a small area of infiltration, in the middle of which one suspects the presence of a small cavity. There are no physical signs of the pleurisy which she apparently had three months previously.

It was a difficult matter to decide whether one should take the risk of operating on this patient or not. The type of lesion in the left lung was certainly suitable for operation, but the presence of some disease on the right side, and the history of a probable pleurisy on that side three months before, suggesting as it did recent activity, indicated the necessity of caution. However, as she was running a practically normal temperature and a pulse of 70 to 90, and as there were no clinical signs of activity in the right side, I finally decided that the posterior operation at least might be undertaken. Accordingly, on October 6th, under gas oxygen and novocaine anaesthesia, I resected the tenth to the sixth ribs inclusive in lengths of from four to three and a half inches. The heart was felt beating very superficially under the seventh and eighth ribs, having obviously been pulled backwards by the fibrosis of the lung and adhesions to the posterior pericardium. The lung was felt diffusely infiltrated and hard in the upper third of the incision, but was softer in the lower part of the lobe. The wound healed per primam. On October 26th the second stage was done under the same anaesthesia, and the second, third, fourth and fifth ribs were resected in lengths of from one to three inches. The heart impulse was felt quite superficially in the posterior axillary line. The lung was diffusely and densely thickened.

The patient stood both operations quite well, temperature rising for a few days up to 100, and pulse up to 120. Respirations were some-

what quickened up to 30, but within a week, on each occasion, temperature and respiration returned to the pre-operative level, but the pulse remained on the average about ten beats faster. The amount of sputum was, however, not diminished although it became somewhat less purulent and more frothy. The amount varied from three to five ounces in 24 hours. On November 25th Dr. H. B. Cushing reported as follows: "General condition good but appears more nervous than formerly. No sign of increased disease in right lung. Left chest markedly collapsed especially in lower part. Skiagraphs and physical signs indicate that little effect so far has been produced on the bronchiectatic cavities grouped around the root of the left lung. Heart in about the same position as before."

On November 27th she was given an autogenous vaccine of 50,000,000, which was not followed by any particular reaction, and on December 4th another dose of the vaccine of the same amount. This second dose was followed by a marked reaction, temperature rising to 100, pulse to 100 to 110. She felt generally miserable; lost appetite, had a little pain in the right upper chest, anteriorly, although Dr. Cushing could find no pleuritic signs to correspond. There was also slight cyanosis with some increase of sputum. The anterior operation was postponed on this account for nearly two weeks, by which time she had largely recovered, although still not so well as before the vaccine. Pulse remained fast. Dr. Cushing thought this partly mechanical from pericardial adhesions drawing the heart up to the left axilla, and suggested that liberation of the pleura might relieve interference with heart action. X-rays showed some breaking down in the small area of consolidation at bottom of sound side: otherwise no change on that side. After considerable hesitation the anterior operation was decided on. It was proposed to her, indeed, that she should go back to California and wait for six months or a year; to which she answered that if she went home she would never come back. On December 20th the third stage was done. Horseshoe flap of skin and fat with base at left shoulder. Muscle flaps formed of greater and lesser pectorals. Resection of first, second, third, and fourth ribs, in lengths of from 1 to 2½ inches. Base of heart and large vessels occupied the inner half of space exposed, lung being contracted towards the axilla. Thorough apicolysis anteriorly and over the apex down to second rib behind and round the axilla till one met dense adhesions under the area exposed at the second posterior operation; too dense to separate without danger. Muscle flaps filled nicely the cavity created. Closed without drainage.

This operation was badly borne, especially by the heart. The pulse immediately ran up to 140, respirations to 32, and they remained at about this level for two days, the temperature, however, keeping about normal. Under digitalis, atropin and heroin the heart steadied down, the pulse dropping twenty points. There was paradoxical respiration and obviously some strain was being put on the other lung. The sputum was thick and cough was unproductive. She vomited also frequently

for thirty-six hours. It looked, however, at the end of the second day as if she were going to come around quite well, but at this point fever appeared and on the third day reached 101.3 while respirations went up to 30 and pulse to 132. Some cyanosis appeared and Dr. Cushing found an area of impaired note over the right lower lobe behind with numerous crepitant râles, but no definite blowing breathing. This went on on the fourth and fifth days into an obvious broncho-pneumonia with infective bronchitis. She became more cyanosed and on the sixth day she died from a filling up of the sound lung, with gradual exhaustion of the heart. Death was obviously due chiefly to an acute infective process in the sound lung, which was probably brought on by the mechanical strain put upon it by the operation, but was also due, in part at least, and primarily, to the mechanical interference over the heart area and the loss of a certain amount of support from the side of the chest wall to which it was adherent and to the interference with the respiratory movements of the diseased side. If she had not had to start with a mild infective condition, tuberculous and also probably mixed, in the bronchi of the sound side, she would have recovered, inasmuch as she had rallied quite well on the second day.

The lesson therefore is that we erred in taking a chance with a so-called relatively healthy lung which proved to be not healthy enough. It emphasizes the importance of demanding that the other lung shall be really sound before one does an extensive thoracoplasty. In this case I ought to have refused to do the final stage with apicolysis, and should have insisted that she return home and wait for six months or a year in order to get stabilized again, recover from the ill effect of the autogenous vaccine and from any recent activity (suspected, if not proved) in the sound lung, and allow the full development of whatever benefit the posterior operation might bring about during the next six to twelve months. I believe that after that length of time fibrosis would have been materially advanced and the right side would have become more certainly quiescent. And even if these hopes had not been realized she would not have been any worse than before the operation. In very advanced cases there must always remain at least 15 per cent. unimproved.

I have to add one further case in which following an extrapleural thoracoplasty over the upper lobe (resection of second to the seventh rib), the lower lobe being compressed by an artificial pneumothorax with some fluid, an old focus at the apex of the sound side, apparently quite arrested, began to break down three months after operation and ultimately developed cavity. This patient reports herself two years after operation as feeling well generally, able to take some exercise, but still has a moderate cough and a small amount of sputum, which from time to time contains bacilli.

These then represent the total of the cases in which operation resulted unfavorably. I have thought it wise to report them in order that those who are interested may be helped in forming their own judgment upon the suitability of a given case for operation. But it is to be realized on the

other hand that the three fatal cases concern patients who had all been far advanced for many years, and were quietly but steadily losing ground, whose expectation of life could not be long, and for whom climatic and hygienic treatment could accomplish nothing more. They point the moral that if surgery is to be considered at all it should be given a chance at an early date. One might state the proposition simply in this way: taking the cases in which it has been decided that an artificial pneumothorax ought to be induced, if a few attempts to get air into the pleural cavity succeed insufficiently or not at all, the question of operative interference should be at once considered very carefully; and in the absence of serious reasons against operation a thoracoplasty ought to be advised. It is useless to waste time with more than three or four punctures. If the pleura can not be entered after three or four attempts it is very unlikely that air can be got in with a dozen more attempts. And there is always the danger of the escape of infection from the lung along the needle track. If, however, a pneumothorax can be established over part of the lung and the rest of the lung needs to be collapsed, one can do a thoracoplasty over the area not affected by the pneumothorax.

I would add a note upon the remaining cases that have been benefited by the operation. These will be reported upon more fully later. They number six. In two the ordinary complete posterior resection was done. In two others an anterior apicolysis with muscle flap insertion was done, in addition to the posterior operation. In one the lower half of the ribs, posteriorly, were resected leaving the upper lobe to be compressed by a previous pneumothorax, while in one other the upper ribs were resected and apicolysis done, leaving the lower lobe to be compressed by pneumothorax. The last case, as already mentioned, after marked improvement for three months, suffered a flare-up in old apical disease of the sound side, which later broke down into a small cavity. Nevertheless, sixteen months after operation her general condition is much better than it was. This is the only relatively unfavorable result. All the others have experienced very great improvement. Cough and sputum have been very greatly reduced, if not quite abolished, fever has disappeared, and general condition has been very much improved. Bacilli have disappeared from the sputum in several. Two have been enabled to resume light work for six hours a day.

While it is too soon to speak of "cures" (using the term in the sense given it by Sauerbruch — disappearance of sputum, general well-being, and ability to work), it would look as if the majority of the patients had been so improved by the operation that they could look forward with a great deal of hope to a resumption of ordinary activities, when previously the outlook in that regard seemed decidedly dim.

Great judgment and a good deal of caution is necessary in the selection of cases for operation, and very close coöperation between the specialist in tuberculosis and the surgeon is essential.

DISCUSSION ON PAPER BY DR. ARCHIBALD

Dr. Philip King Brown, San Francisco: The surgical treatment of two cases which I wish to report was inspired by the work of Dr. Archibald and operated on by Dr. Leo Eloesser, a surgeon in San Francisco. I can add nothing to what Dr. Archibald has said, except to refer to one or two little things that we found helpful in dealing with such cases. Both cases were done in one sitting each.

The first patient had a large cavity at the left apex, pneumothorax was unsuccessful, and the lung clear to the base became infected as well as the apex of the other side. We tried Dr. Webb's postural rest on this patient, as well as on the other one, unsuccessfully, and we determined then to do this operation. I am going to show you, in a photograph, the amount of rib removed.

The cavity in this case was not wholly compressed by the operation because the first rib was not resected. This patient awaits the completion of the operation in a second step, to make effective the complete compression of a large cavity for which there is no treatment in the world except surgical treatment.

This next patient was hospitalized for six or seven years in the East, and also a year or two in the West. She had a large pleural effusion on the right side, with a huge cavity. The ribs were resected, as much as six inches of some of them, and the cavity completely closed much more successfully than the other one, due to the fact that the resection of part of the first rib was absolutely necessary. Both patients have had less cough, fever and expectoration since operation and while the end result is not to be determined as yet, they are both very markedly better.

I want to emphasize a further point made by Dr. Archibald, that it doesn't do to leave these things to be matters of last resort. It is not fair to the surgeon and not fair to the patient. It is wise to try pneumothorax and postural rest on these cases for a time, but if you get no results in lessening of the sputum, cough and fever then you want to consider immediately the question of surgery. The maximum length of rib removed in either of these cases is six and seven-tenths inches, and the smallest amount at the top is one inch. The photographs of the patients after operation show how little the deformity is, and the fact that the arm function is not interfered with.

The only thing that I want to say is that we learned a little trick about this thing, to minimize the pain, and that was, that while the patient was still under the effects of the local anesthetic, the injection of the proximal end of the intercostal nerve with alcohol keeps him free from pain for about a week. It is a painful thing to do, if you have ever tried it for pleurisy; the shock of it is great indeed in some cases and the pain is excruciating, but while the intercostal nerves are anesthetized it is simple indeed to do it, and it gives immense relief during convalescence after the operation.

Dr. Archibald: I was forgetting to acknowledge my indebtedness to various medical men, as I ought, and as I want to do. I would like to

say that cases have very kindly been referred to me chiefly by Dr. Parfitt, of Gravenhurst; also by Dr. Lawrason Brown, Dr. Byers, Dr. John Lloyd, Dr. Pottenger and Dr. Patterson, to all of whom I owe hearty thanks.

Dr. Charles L. Minor, Asheville, N. C.: I rise to defend the internist. I recognize that many an internist puts off, however, and sends the surgeon rather than the undertaker. We recognize the unfairness of that to the surgeon. After all, when you recommend to a patient what to him is so serious a matter as a surgical operation, you have to feel very sure that it is very thoroughly indicated. It may be true that pneumothorax, as many men indicate, could be used in incipient apices, but we don't do it, as we all know. It is a question, therefore, of judgment as to how soon we must interefere. To wait until you have a moribund patient is useless. The condition however, must be one which cannot be relieved by other measures.

I had a case recently where pneumothorax failed to collapse a bleeding cavity. I had the man operated on, and so far as I can judge, successfully. Now, on the one hand, to have let that man go along and finally bleed to death would have been bad practice, but on the other hand, to take an incipient case and subject him to a serious operation when not absolutely needed would be far worse. The surgeon must remember that while we want to consider the surgeon, we have also to consider the patient.

My chief objection to Dr. Archibald is that he is so far away in Canada. A man who is such a master ought to be more available so that we can have the benefit of his skill.

Dr. Alfred Meyer, New York: I think perhaps a word should be said with reference to Dr. Archibald's modesty, on account of the proportion of deaths he has had. I remember a visit to Davos in 1906, where I was shown a large collection of ribs that were resected from cases of the type described, and they were shown with enthusiasm. I heard that all the patients had died as a result. Of course, the operation was a success, but the patient ended his days.

Now, that was in the early days of the operation, and in all probability the same criticism was to be made then that Archibald made with reference to the experience we are having in this country — that we didn't get the cases early enough.

But one practical point I think has occurred to me that might lead to a closer observation of radiographic findings in apical cases that are treated with artificial pneumothorax over an extended period of time, namely the determination of whether a slow, long continued attempt at pneumothorax may not finally cause some compression of that localized apical tuberculosis. You will remember that Tuffier, with whom I had a personal argument on the subject, brought forward the argument that most of the lesions being in the apex, and bound down by adhesions, you are getting compression only of the healthy lung, and none of the part involved.

Therefore, there is a study suggested to me in this which could be taken up by those using pneumothorax, to watch and see whether victims are really doomed, or whether possibly a long continued and gradually increased pneumothorax in that type of case does not cause compression of the lesion, in spite of what Tuffier says and what may theoretically appear to be the case. So, in addition to the burden put on the men this morning for a standard of roentgenological picture of the child's chest, this might be another problem worthy of further study.

I want to congratulate Dr. Brown for bringing in that practical point about relief from agonizing suffering by alcohol. That is absolutely new to me, and it may be to others here.

Dr. S. Adolphus Knopf, New York: May I add first my appreciation of and gratitude for the invaluable pioneer work of our Canadian friend and then be permitted to ask the speaker what results he has obtained with non-tuberculous abscesses? I was recently present at an operation for a non-tuberculous abscess in the upper right lobe. It had been the intention of the operator to use adipose tissue to be taken from the abdomen for the purpose of compression. He had, however, the misfortune to rupture the visceral pleura in his endeavor to detach it from the adherent lung. Instead of the adipose tissue, he compressed the lung with gauze. The healing was slow and resulted in a very ugly cavity which bulged after the slightest effort to cough. May I state incidentally, that this non-tuberculous abscess was the result of a tonsilectomy that had been performed on a medical officer while he was in service abroad during the recent war.

Dr. C. D. Parfitt, Gravenhurst, Ont.: I should like to say that three out of the four cases operated on for me have been more than satisfied with the result of the operation. I should like to ask Dr. Archibald if he has any objection to cutting the first rib. In none of these four cases was this cut, and it would seem to me, with apical excavations, that cutting the first would allow considerably more collapse, and reduce the expansion of the lower part of the chest.

Dr. Minor: What danger is there in apicolysis, through violent handling of the apex of the lung?

Dr. David R. Lyman, Wallingford, Conn.: Just a word as to this work that has led him to exclude ether from his operations. That is a very important thing to get over to the surgeons of the country in general, I think.

The Chairman: Is there further discussion?

Before calling on Dr. Archibald I would like to say a word to express, I think, on the part of us all, our appreciation of this pioneer work that Dr. Archibald is doing. It is my experience, which I think has been repeated in other places, that the surgeons are very loath generally to tackle these cases, and in my personal experience in a hospital where I am confined, in the selection of surgeons, to a group of perhaps four or five on particular service, I have been unable over a period of several

years to get anyone really to take a systematic and intelligent and scientific interest in the development of these operations.

So we find there, an unusual situation of the internist trying to get the surgeon, instead of the surgeon blackguarding the internist for having the cases become so advanced.

I will ask Dr. Archibald to close the discussion.

Dr. Archibald: I want to thank you for the kind reception given to my paper.

What Dr. Minor says is always interesting, and nearly always right. In this instance I think he is perfectly right. I regret very much that I am so much on the fringe of things, because my interest is such that I would welcome further opportunities of studying the matter.

I would not like to be understood as adopting the ordinary stock attitude of the surgeon, which is usually summed up in the phrase "You sent me this case too late," a phrase which, as a matter of fact, sometimes covers a multitude of surgical sins. I realize to the full the difficulty of coming to a decision, which is very largely, indeed, the difficulty of establishing a prognosis. Prognosis is dubious, and I suppose that in no subject in medicine is judgment more difficult.

Not only that, but, as Dr. Minor might have said, when the question of operation is suggested to the patient and the patient's relatives, immediately one has to admit that this is a new thing, bringing in new risks. The operative risk, after all, is a thing that you can't underestimate, and as a matter of fact, one of my objects in talking about this question, and particularly in discussing the fatal cases, is to emphasize the fact that there is a risk. Yet I believe that the danger of a fatal issue is one that we can avoid for the most part in the future. There is, nevertheless, always a certain risk. You simply have to balance that risk against the risk of doing nothing; and it really has to come, in the last analysis, to a judgment based on your own particular belief as to what is going to become of that patient if something is not done. That is your business, in a sense. It is also partly our business. We have to estimate the patient's resistance to operation. We know more about operations than you do, and we can usually cast some sort of judgment as to whether a patient will resist a given operation or not. But in this also team work is the best. The point that I was trying to make was that I don't want Dr. Minor to think that I want to drive through the ranks of the medical men with the bold statement that they must refer their cases at an early stage, only my plea is, that after pneumothorax has been found impossible, one should take up seriously and with no long delay the question of surgical interference.

I welcome Dr. Brown's suggestion of alcohol. It is true that some patients suffer a great deal. I shall adopt that in the future because I think it will help in the matter of coughing and expectoration; and that is important.

I am delighted to see that others are doing the work, because one of my objects in talking about this thing is that, in the various parts of the

country, there should arise a school of surgeons who would take particular interest in tuberculosis. These have to be trained by you in what they should do. Through team work a lot of good may be done.

As regards the question concerning the compression of the apex alone by pneumothorax, it is true that certain cases are helped by pneumothorax, but other cases do badly. These you have to select for apicolysis,

As to the effect of additional pneumothorax on non-tuberculous abscesses, I would say that, for an acute abscess within the first two or three months, it is valuable. In such conditions, rib resection should not replace pneumothorax. In chronic abscesses in the lower lobe, I have found that rib resection is not much good. You simply have to go in, drain, and take your chance, and it is not an awfully good chance, either.

In regard to Dr. Parfitt's question, we have not usually cut the first rib. The muscle flap fits in under it nicely; whereas you get a slight falling of the shoulder, if you do resect it.

As regards dissemination following apicolysis, I have not seen it.

Dr. Minor: Do you think it possible?

Dr. Archibald: It might happen.

With regard to Dr. Lyman's point on ether, I have found, in a long series of operations on tuberculous subjects for other conditions, as well as for pulmonary and intestinal cases, that ether is followed by a definite percentage of acute bronchitis (with in two or three cases apparent dissemination), and this in at least thirty to forty per cent. greater proportion than when gas is used. So that I have come to the conclusion that ether is irritating and ought to be avoided.

DETTWEILER AND HIS METHODS*

By Hugh M. Kinghorn, M.D.

Saranac Lake, N. Y.

Peter Dettweiler was born on the 4th day of August, 1837, in Wintersheim near Worms and was the son of a tenant farmer. His first pulmonary hemorrhage occurred while he was a student and he then entered upon a long series of years of illness. Finally, however, he became cured of his pulmonary tuberculosis and then paid very little attention to it. He was a field physician during the wars of 1864–1866 and 1870.

His pulmonary disease caused him to go to Brehmer at Görbersdorf. He was first a patient and later an assistant of Brehmer, and at this time his observations both on himself and on others convinced him of the real curability of pulmonary tuberculosis. He seized this idea with enthusiasm and allowed it to rule his entire life.

As his ideas ripened they gradually became opposed to Brehmer's. This led to differences of opinion and the two men finally separated. Dettweiler's high opinion of Brehmer, however, was not confined to himself, but was transmitted by him to his own pupils.

The use of the rest cure in the open air must be considered Dettweiler's greatest service. He also constantly asserted that climate and elevation play no essential rôle in the treatment of pulmonary tuberculosis. Only by accepting these conditions would it be possible for the method of treatment to become of general good to the physician, and to consider the establishment of sanatoria on a large scale for less wealthy classes of people. Dettweiler himself gave the practical example since he established the first German people's sanatorium. This was first started at Falkenstein in addition to the institution which was already there for well-to-do persons. It was soon, however, removed to Ruppertshain in the Taunus Mountains.

Dettweiler got his greatest experience at the institution for the well-to-do people at Falkenstein. Practically speaking, this also owed its prosperous existence to him. He was director of the institution from 1876 to 1895 and the reputation of the sanatorium became world wide. In 1895 he retired from its direction and became a consulting physician. From his cottage in Cronberg in the Taunus Mountains he carefully observed not only the doings of the institution at Falkenstein but the whole movement directed against tuberculosis. He was chiefly interested in the

* Read by title.

spread of the people's sanatoria. It was a great satisfaction to him to see his own practical example become general to a large degree.

He died on the 12th of January, 1904, in Cronberg, at the age of 67 years. His death was from paralysis of the heart (Herzlähmung) and was very unexpected.[1]

Rarely has a valuable medical measure been so quickly accepted by the medical profession and with so little opposition, as the rest treatment and particularly the open air rest treatment in pulmonary tuberculosis. The cause of this lies in its simplicity. Although we owe to Brehmer the first elements of the present day treatment of phthisis, it is quite remarkable that he never grasped the great significance of the open air rest cure. Even up to the time of his death he was unable to accept it.

Dettweiler was a patient at the sanatorium at Görbersdorf during the summer months of 1868 and 1869, and was second physician in the institution from March, 1870, to August, 1875, with an intermission of seven months due to the Franco-Prussian war. At this time the use of fresh air by the patients was limited to their walks, and to the abundant opportunities to sit in the park and forest. Both depended upon the strength of the patient and the atmospheric conditions which prevailed at the time, and which are just as changeable in the mountains of Silesia as in the other mountainous districts of Germany. As a consequence patients were compelled to remain in their rooms for a greater part of the time, particularly in the unfavorable seasons of the year. These rooms, moreover, were not fully suitable. Partly on the advice of Dettweiler, but stimulated particularly by the treatment which was being so successfully carried out at Davos during the winter, Brehmer determined to erect new buildings, so as to correct these unfavorable conditions as much as possible. Comfortable, hygienic and relatively favorable rooms were obtained, and, for that time, the new buildings were almost luxurious. Only the more vigorous patients, however, were able to brave the frequent changes of weather and take systematic walking and mountain climbing exercises. Very many cases became hardened by them. Dettweiler asserts, however, that others were harmed by the forced exertions and the frequent inability to sit down and rest when they wished to do so.[2] Brehmer, however, states that in about fourteen thousand tuberculous patients he could point to only one case which was harmed by over exertion of the heart, and that this patient suffered harm and afterwards died as a result of disobeying orders.

While Dettweiler was in Brehmer's institution he was suffering from pulmonary tuberculosis and had abundant opportunity to observe a great many patients. He soon concluded that "the consumptive is a physical and usually a nervous weakling, and needs much more of rest than one ordinarily assumes." Proceeding from this viewpoint he began to use the hammock in the summer of 1868. In the war of 1864 he had used it with great benefit. Hammocks were soon used during the good summer months by numerous other German health resorts.

Brehmer and Dettweiler, however, did not at this time think of a continuous open air rest treatment during the late months of the year. It still needed many experiences and a slow ripening of his judgment in the first years of his management at Falkenstein before Dettweiler had the courage, at the end of 1879 and beginning 1880, to make the first serious attempts at a real permanent open air treatment, even in the so-called bad seasons of the year (late autumn, winter and early spring). He began with some very sick patients whose continued confinement to bed in their rooms seemed to be very painful and unsuitable, and he hoped to influence the fever favorably by means of the cold air. These patients were preferably intelligent and tractable women and they encouraged him to carry out the experiment during the first winter.

At first beds were used from the patients' own rooms. When, however, the beneficial results of the new procedure were so evident with the great majority of cases, he soon proceeded to make methodical arrangements for the open air rest treatment, to which also the more vigorous patients would now be subjected. The wooden porch was torn down and renovated in iron and glass. Soon a second one of similar construction was erected. He also built several large garden pavilions which were protected from the wind. These were all near the house at the entrance to the park.

As regards the winter treatment at Görbersdorf, and in the first years at Falkenstein, both Brehmer and Dettweiler were satisfied with improvement in the medium grades of the disease in the majority of patients of the more robust class who bore the walking and mountain climbing exercises and the inclemency of the weather favorably. With many of the distinctly advanced cases they were satisfied if these passed the winter tolerably well and without particular damage. Later on at Falkenstein, by further perfection of the method, through constant supervision and instruction even to the most minute detail and by the extraordinary results of the prolonged open air rest treatment, Dettweiler's views completely changed with regard to winter treatment.

The claims of Dettweiler and his associated physicians and also of the patients for the success of the treatment increased, and they all became more and more convinced that the winter treatment was just as favorable as that of the summer.

He was soon convinced that the prolonged use of fresh air and light in the resting position under proper guidance and with suitable precautionary measures and appropriate clothing brought about the most beneficial results for the numerous disturbances of the entire tuberculous organism. There was first observed a feeling of well being which, previously, had hardly been known. This was felt even by the seriously ill patients. Return to their rooms to bed was feared by them more than anything else.

It was soon seen that, in the majority of patients, fever soon began to decrease, the heart action became quieter and stronger and cough diminished. Sleep improved in rooms in which the air was constantly fresh from an open window, and on account of the fatigue occasioned by the

long use of fresh air and light during the day. Night sweats disappeared almost completely, as did also chills. One of the most impressive facts to the patient was the increase of appetite and weight, which in the majority of cases coincided with the improvement in the lung and general condition.

A thing which to Dettweiler had a particularly important significance was the teaching and educational lesson and the better supervision of the patient by the physician, which was first rendered possible and made easy by the rest treatment. He constantly criticised Brehmer for the latter's laxness in the supervision of patients. Brehmer's patients visited him professionally when they wished, and not at stated times, and it was not until the last years of his life that he remedied this. In the limited time of a visit to a sick room, Dettweiler found it very difficult to give the necessary instructions. These were best and most easily given during the daily visits of the physicians in the rest pavilions (Liegehalle). This was a long open gallery protected against rain and inclement weather. He believed that by the general employment of his methods the existing climatic and geographical limitations which had existed until then must pass away; in other words, that the successful treatment of the disease could be carried out anywhere, and that it was not restricted to mountain regions. In this he was entirely opposed to Brehmer and the Davos physicians, who insisted that pulmonary tuberculosis could be successfully treated only in the high mountain regions.

Dettweiler's view was completely confirmed by the surprising results of the sanatoria in the mountains with only a moderate elevation, and of those on the low levels, and later by the proof at Falkenstein that changes in weather had no observable influence on the course of the pulmonary tuberculosis with expert treatment. Now, there are only a few who believe in a real specific influence of climate. Specific actions are only of second and third rank. The assertion which Dettweiler made very early in his career, that the consumptive could be treated with great benefit in his own home climate under the suitable employment of the open air treatment, has been completely confirmed.

It will be of value to describe in some detail Dettweiler's open air rest treatment. He considered the most extensive sojourn in the fresh air, the prolonged fresh air baths, as the most powerful means of help which we possess. A sick man can be hardened by fresh air if subjected to it for a sufficient length of time.[3] In Falkenstein the treatment was called the "permanent or continuous fresh air treatment," and for some years it had had a specific significance. In order to carry it out special arrangements were necessary and there must be a constant friendly intercourse between the physician and patient. There is hardly any change of weather occurring at any time of the year or at any time of day or night which cannot be rendered profitable to the patient with pulmonary tuberculosis. On the sheltered terrace between the two wings of the main building airy glass pavilions and rotatory pavilions were built. In these there were about ninety lightly upholstered bamboo chaises-longues on

which the patients with suitable covering passed the entire day with exception of the meals and walks. In the good season of the year this offered no difficulties. Emboldened by the results, he made it a rule that all patients should live in the open air with every change of weather, even with heavy fog, snowstorms and a degree of cold even to 10° and 12° below zero, with the exception of those confined to bed and to the house by intercurrent accidents or by severe illnesses. As a result of this prolonged winter air therapy, he obtained astonishing results.

Particularly zealous patients passed from ten to eleven hours of a so-called medical day in the open air in the winter months. Of these there were only a few, probably about six per cent.; eight per cent. passed over nine hours daily; eight per cent. over eight hours, eighteen per cent. over seven hours, eighteen per cent. over six hours, twelve per cent. over five hours, etc. The remainder remained under this minimum and only a small number were entirely confined to the house on account of advanced disease. He found only a very few patients who did not choose for themselves the above-mentioned treatment: these were the highly anæmic patients and those with certain forms of continued fever, who became susceptible to chills and high temperatures from even the slight influence of cold. Five to six hours in winter was the average for the majority of the more weakly patients and the fever cases. These latter were only able to begin their open air treatment in the afternoons on account of chills. As a result their treatment finished late in the evening. Behind the beds arranged in long rows along the walls of the pavilions, gas jets and lamps with reflectors were put up so that the patients were able to read and write or play light games with their neighbors. The winter's day was often ended at about 10 o'clock in the evening and the patient then returned to a cool, thoroughly aired, sleeping room. Dettweiler particularly emphasizes the surprising tolerance of the patients against inclement weather and the remarkable diminution in the cough and the increase in metabolism and also what seems to be a favorable influence on the fever. His results demonstrated that this treatment could be carried out during all times of the year. With proper precautions one could use every change of weather with advantage. It was, of course, necessary to have suitable and warm clothing, and patients were instructed to be guided by the thermometer and not by the season of the year with regard to this. If the patient was properly clad and kept the mouth closed and breathed through the nose, he could pass the day in the open air in almost every kind of weather, except when there were dry or cutting winds.

Special instructions were given with regard to sitting in the open air since this practice caused most mistakes, and as a result there were frequent colds in the good season of the year. In winter a patient will clothe himself properly for his walk and will remain in motion and keep from resting until he returns to the house. It is different in summer: the cool air is often harmful and he observes too late that he has cooled off more

than he should. It is necessary always to give most impressive individual instructions.

When delicate patients began to exercise they were allowed to walk without stopping not longer than fifteen or twenty minutes, and if they did not immediately rest in the reclining position well covered, to sit only slightly longer than a similar time. In this way they would not over-exert the heart which was usually weak, and would not perspire. In addition to this the superflous heat produced by the exercise suffices for an extended period of sitting out and the patient is able to bear without harm the loss of heat which sets in. To warm up the anæmic patients and those with chills he found frequent and small doses of good alcohol to be very useful.

It will be remembered that Brehmer insisted that pulmonary tuberculosis could be successfully treated only in the high mountainous regions. Dettweiler was completely opposed to this view. I have already briefly touched upon this point but as the latter was the first to emphasize the fact that phthisis could be successfully treated anywhere, I will go a little more fully into his views. He did not say that every climate, every change of weather at every location could be utilized equally well to treat phthisis. From their situation there are more or less favorite points in which the opportunities to catch cold, the possibility of the daily use of fresh air, the greater or less stimulation of metabolism are different. One can create a local climate up to a certain degree by proper clothing, and by building suitable structures, and one can cure the disease in every pure, fresh air, best of all in mountain and forest air. He observed cure of the most diverse forms of phthisis to occur in every season of the year. From the many hundred cases which he had accurately observed, he came to the conviction that the traditional law of the special usefulness of particular climates was opposed to his experience, and that the treatment of phthisis depends fundamentally upon something else than climate, namely upon the individuals and the manner in which they will make use of the conditions around them.

Dettweiler's views with regard to breathing exercises and mountain climbing exercises are very important. He said that in ordering deep breathing and mountain climbing one frequently proceeds in a general way and allows patients of all stages of the disease to choose their amount themselves. The lungs are apt to be exclusively considered. We must not forget, however, the very close relation between the organs of respiration and those of the circulation and the heart. These two systems must not be considered separately. The dependence of one upon the other is so great that functionally they should be considered together. Every change in the condition of one is reflected immediately in the behavior of the other. Purposeless mountain climbing which is too frequently ordered in an indefinite way and which is not sufficiently individualized, and which is still more frequently carried out in a senseless manner, may have very harmful results on the heart and diseased lung and the entire organism. In hill and mountain climbing we do not deal with

an increased work of the lung; the lung, really only a gas filter, does not work of itself; it also does not tire; the relative lack of nerves points to its passive condition. Its function is effect of the work of other organs. We are dealing, however, with a work of the entire muscular system, above all of the heart and of the thorax muscles, whose fatigue is immediately manifested in local and general disturbances, particularly in those of the cerebral nervous system. Each year he had to deplore well marked cases of over exertion of the heart as a result of misused athletic feats which to the healthy person might seem inconceivably small, and this in spite of the most firmly enforced orders. One can very well understand how much more frequently disturbances, indeed complete failure of treatment, must occur with less cautious patients with regard to this.

During the first periods of treatment he allowed his patients rather too much than too little rest. If there was heart weakness and high grade anæmia, every exercise was limited to what was most necessary, and intensive rational nourishment was given to the patient and the entire day was passed on a comfortable bed in the open air, in the shade, and sheltered from the wind, or else passed in the winter garden. Mild fatigue of the heart muscle often first showed itself after the first smaller climbing exercises had made the patients bolder. Firm control of them should be observed in the early stage of treatment.

Exertion should be followed only by pleasant after effects, and a gradual increase in exercise should be allowed only in such cases, and according to the principle: rather more often and shorter than less often and too long. If after a walk there should occur paleness of the skin with slight cyanosis, tendency to dizziness and to yawning, mild tightness of breathing, feeling of discomfort and a more or less troublesome sensation in the region of the heart which will be described differently by each patient, with frequent loss of power of the heart action, absolute rest should be immediately ordered. All further attempts at walking must be forbidden if even a single one of these symptoms be distinctly marked, or if they are present even by way of suggestion. A single, severe, fatiguing walk into the mountain, which a patient may take too soon in the glad feeling of returning strength, often throws him back completely. Sometimes the injury is adjusted by some days of greater rest. The ill result occurs more frequently with women than with men, since with the former the condition of anæmia and heart weakness occur more frequently.

Deep breathing should always be employed in a very moderate way, and should depend upon the condition of the heart and the disease in the lung. At very frequent intervals during the day, the patient should take single deep breaths with closed mouth. While walking and going up hill patients were instructed to take from six to eight deep respirations at intervals of one to two hundred paces in such a way that two to three steps be taken for inspiration and the same for expiration, according to the capacity of the lungs. This must be discontinued for a day if there be chest pains which are of muscular origin, or with tearing of adhesions.

Also if there be a feeling of giddiness and tightness in the breast, one can conclude that he has done too much. The power to breathe deeply gradually increases and the patient observes that he can do his exercises without palpitation and more frequent breathing. The value of deep breathing lies not only in the ventilation of the lung, in the acceleration of gaseous changes, and in improvement of the circulation, but in many in strengthening the thorax muscles, particularly those of the upper aperture.

Dettweiler's bed rest treatment of fever was very thorough.[4] He used continuous rest treatment in the open air together with super-alimentation. The mouth was used to measure the temperature. He found that the other methods of measuring temperature, for instance the rectal method, caused great inconveniences and interrupted the cure. For all practical purposes mouth measurement was sufficient. Upon the first outbreak of fever, especially if it was of an inflammatory character, he employed absolute bed rest, usually preceded by the administration of a diaphoretic.

While Brehmer is the great outstanding figure in the modern treatment of pulmonary tuberculosis, it is with difficulty that we place Dettweiler second in importance to him. In my judgment, Dettweiler had a far greater grasp of the treatment than had Brehmer. The latter, however, was the pioneer and gave the first impetus to treatment. At present, I think our technique in carrying out rest and exercise treatment has improved on Dettweiler's, but very little has been added to the fundamental principles of his treatment.

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SMALL PNEUMOTHORAX IN TUBERCULOSIS

By Nathan Barlow, M.D., and James C. Thompson, M.D.
Surgeons (Reserve) United States Public Health Service

(Abstract of a Monograph)

The limited space at our disposal makes it necessary to defer all explanations, discussions of abstruse questions, references to literature, and acknowledgements of indebtedness to our detailed report, and as a consequence, only those applications of our work which are most obvious can be even mentioned in so brief a paper. In presenting to the profession a report of a condition which has important and practical applications to both the diagnosis and treatment of tuberculosis, but which has been almost entirely overlooked by the keenest investigators up to the present time, we feel that a brief explanation is due as to why the frequency of the condition has not been recognized before.

We owe the greater part of our knowledge of disease conditions and the interpretation of physical signs to the pathologist. We have very justly come to feel that any interpretation of physical signs or clinical symptoms which can not be confirmed at the post mortem table must have conclusive proof of some other nature before it can be accepted. The small pneumothorax which we are considering is not a permanent pathological change of the pulmonary tissues, but it is a temporary displacement of tissue and usually disappears before or during the terminal illness.

The few which do persist are destroyed when the pleural adhesions are separated at post mortem. As these temporary structures are very frequent in tuberculosis, and rarely if ever occur in other diseases, the changes in the physical signs which they produce have naturally been considered as due to the pathological changes which were evident at the autopsy.

A pneumothorax is easily recognized in the x-ray plates only when it extends from the anterior to the posterior walls of the thorax, so that there is an area upon the plate which is entirely free from lung markings. The smaller ones which we are considering are very seldom situated in exactly that location, so that there is usually no area upon the plate which is free from pulmonary markings, and if the displacement is either anterior or posterior, there may not even be any definite area of decreased density. The diagnostic criterion is therefore a definite separation of pleural surfaces. This can only be perceived in stereoscopic plates taken by a technique adapted to its demonstration in that particular

patient, so that while routine stereoroentgenograms will demonstrate this separation in a certain number of patients, in many cases it is necessary to give the special attention to details of technique which are discussed in our report. The actual vision of separation of the pleural surfaces requires not only facility in the use of the stereoscope, but also, in the majority of cases, considerable experience in the study of small pneumothorax. If the detection of a small pneumothorax depended entirely upon the attention being attracted by this separation, we doubt if we ourselves would find more than a small percentage of the small pneumothoraces which are present.

Fortunately, the changes produced in the arrangement of the markings are of such a nature that they can be usually recognized as different from those which occur in pulmonary tuberculosis unaffected by pneumothorax. We have called these peculiar arrangements and distributions of densities "indicating signs." We describe a number of these in our report; the most easily recognized are deviation of the trachea and mediastinum, annular shadows, and bands and zones of density and rarefaction which do not conform to those which would be expected from any probable course of development of a tuberculous process. The deviation of the trachea or of one wall is the most easily perceived of any of these, is usually angular when recent and points toward the side on which the pneumothorax occurs. That is to say that while in large pneumothoraces, the trachea, mediastinum, or heart are deviated toward the opposite side, in small local pneumothoraces the deviation is toward the side on which the pneumothorax lies. Annular shadows lying either at the surface of the lung, or in the region of the interlobar septa, occur in a certain percentage of localized pneumothoraces in these regions and when present afford an easily recognized indicating sign. Areas of rarefaction and bands or zones of density which do not conform to the ordinary locations of a tuberculous process and which are difficult to explain are often produced by localized pneumothorax, and when present should lead to scrutiny of the plates.

We classify small pneumothorax in different ways. The most obvious classification is into a superficial and deep group, the superficial comprising all those in contact with the pleura of the thoracic wall and the deep group comprising all those which lie entirely upon the mediastinal or interlobar surfaces of the lung. Clinically, the most useful classification is into central and lateral groups. The central group includes all those which lie in relationship to the median half of the lung. The lateral group includes not only those of the superficial group which lie over the lateral half of the lung, but also interlobar pneumothoraces which are large enough to approach the lateral surface of the lung.

The formation of these small pneumothoraces is discussed in detail in our monograph; briefly, it depends upon the fact that adhesions are first formed and are densest at the periphery of a tuberculous area. The mediastinal and central forms are likely to be long and tubular because the heart in front and the great vessels behind tend to preserve by their

pulsation two bands of pleural surface which remain free from adhesion. The frequency with which these small pneumothoraces are found depends largely upon the technique of both the x-ray and the physical examination and the amount of skill and experience in their detection. It seems that nearly every case of tuberculosis at some time or other presents one or more of these structures. In a careful study of over a thousand cases of non-tuberculous disease, we have found no instances of the presence of a small pneumothorax in the areas which are characteristic of tuberculosis. The partial pneumothorax which occasionally occurs in streptococcic pneumonias and similar conditions is entirely different in size and location and should cause no confusion.

The striking physical signs which are characteristic of large partial or complete pneumothorax are not usually encountered in the small forms which we are considering. The metallic phenomena, marked tympany, and complete suppression of all breath sounds are not characteristic of very small pneumothorax. With one or two possible exceptions there is no single sign which cannot be produced by other pathological conditions. It is natural therefore that the changes in the signs which are caused by small pneumothorax should have been attributed to other and more generally recognized changes, and that many examiners have adopted a technique which accentuates the physical signs least affected by the presence of a localized pneumothorax, and have learned to disregard the discrepancies in the results of different diagnostic procedures, which we so constantly encounter in the course of our physical examinations.

The physical signs of the superficial group are more obvious than those of the deep group. On inspection, deviation of the trachea may be perceived together with the usual signs of early tuberculosis. On palpation, deviation or broadening of and distortion of the trachea may be perceived. Changes in the muscles, and other palpation signs of early tuberculosis are usually found, and occasionally the pneumothorax may be outlined by palpation of the tactile fremitus.

The primary percussion change of a small pneumothorax is the production of true tympany as distinguished from hyper-resonance. Owing to thickening of, or deposits upon the pleura, this soon becomes dullness with or without a tympanitac overnote and may simulate ordinary hyperresonance or impaired resonance. In the collapsed area, slight or marked dullness is of course to be expected. Percussion often indicates a localized pneumothorax by revealing a deviation of the mediastinum toward the affected side. We have found that small cavities usually produce diminished dullness or slight resonance rather than tympany. A cavity large enough to produce tympany usually gives a low pitched tone, while the tympany of small pneumothorax is usually high pitched. It is sometimes possible to outline both cavity and pneumothorax from the difference in the pitch and quality of the tympany heard over adjacent areas. It may be noted here that the cavities remaining after complete destruction of a considerable part of a lobe by an acute process have their lateral walls formed by pleura alone. The mechanical conditions are so similar

to those produced by a corresponding pneumothorax that the diagnosis by physical examination or by x-ray is very difficult. The differential diagnosis is discussed in our monograph.

In early tuberculosis and in slowly progressing, moderately advanced tuberculosis, the majority of the conditions which are diagnosed as "superficial dry cavities" are not really cavities, but small pneumothoraces in which the physical signs are unusually striking. It should be remembered that a small pneumothorax often adjoins or is fused with a cavity of appreciable size, and the physical signs may be due in part to one and in part to the other. We have found that the Wintrich change usually (but not always) indicates a cavity, which may or may not be overlain by a small pneumothorax. The cracked pot sound seems to be more often produced by a cavity and pneumothorax, or by two cavities which communicate, than by a single cavity alone. On ausculation, the changes in the whispered signs are those which are most particularly characteristic of small pneumothorax. Whispered pectoriloquy, especially if of high pitch or with an amphoric quality is much more characteristic of small pneumothorax than it is of cavity. Whispered pectoriloquy which has two different pitches at different points on the chest is usually due to a cavity which communicates with a small pneumothorax. An extension of the tracheal quality of whisper beyond normal limits is usually due to a pneumothorax of the central group. On the contrary, spoken pectoriloquy and bronchophony are usually well marked over cavities but not over small pneumothoraces unless there is free communication with a bronchus. In the region adjoining a small pneumothorax ringing or altered bronchophony or even egophony may be produced whether fluid be present or not. The breath sounds are increased and often given an amphoric quality in recent pneumothoraces which communicate with or are in contact with a bronchus; if in contact with the trachea, the tracheal quality is accentuated. An entirely superficial pneumothorax causes diminished breath sounds, and the formation of pleural exudate causes a diminution of the intensity of all auscultatory phenomena in course of time. Friction sounds cannot of course be produced in a pneumothorax, but over the surrounding adhesions, slight friction sounds of various sorts are frequently heard.

Equally striking are the changes in physical signs produced by the collapse of the lung tissue in the immediate neighborhood of the pneumothorax. These on a small scale are similar to those produced by a complete pneumothorax. The most striking changes are those produced in the râles. If the active process is confined entirely to the region affected by the pneumothorax, the râles may be entirely suppressed. Otherwise they are reduced in number and constancy and their quality is altered. They usually give less of an impression of moisture, and the time of their appearance in the respiratory cycle varies irregularly. We have found a consonating quality added to the râles more frequently by pneumothorax than by a cavity. We usually allude to the altered râles heard in the neighborhood of localized pneumothorax as *partly suppressed râles* or

collapse râles. They include some, but by no means all, of the râles which are variously described as dry, sticky, viscid, atypical, abortive, peculiar, etc. The changes in physical signs in this collapsed area are those usually associated with consolidated tissue. The breathing is more or less bronchial and may be diminished. The voice sounds are increased as a rule, and are often altered in quality; they may be ringing, may have an amphoric quality, and in some cases a true egophony may be heard. Post-tussive puff and post-tussive suction frequently occur over pneumothorax communicating with a cavity.

The diagnosis by physical signs must therefore depend upon an interpretation of arrangements and groupings of physical signs which cannot otherwise be fully explained. These are discussed in detail in our larger report. The diagnosis of mediastinal and interlobar small pneumothorax is frequently possible by physical signs, but the discussion would be too long to be given here, as it involves certain distinctions which are usually disregarded, and assigns an entirely new significance to at least one of the well-known physical signs (d'Espine's sign).

The symptoms of onset are often so slight that the patient does not notice them. When present, they are similar to those of large pneumothorax. Sudden sharp pains in the chest, slight sudden dyspnea, sometimes blood spitting, or occasionally a hemorrhage, nausea, faintness, palpitation, etc. The clinical symptoms resulting from its presence include pain in the chest, particularly substernal pains, disturbances of blood pressure and pulse rate when the region of the great vessels or pericardium is affected by the process, slight dyspnea, and the whole train of reflex symptoms which follow irritations of the pleura. These include dilatation of the pupil, trophic disturbances as of muscle, radiating pains, alterations of the voice and if the diaphragmatic pleura be involved, reflex disturbances of the abdominal walls and viscera.

The immediate effect of a localized pneumothorax depends entirely upon the proportion of the diseased tissue which is collapsed after the formation of the pneumothorax. In very early tuberculosis, it is much more likely that the entire involved region may be more or less collapsed by the pneumothorax. In such cases there may be a complete suppression of râles, and the effective reduction of the absorbtion of poisonous products from the tuberculous focus may be such that the clinical symptoms of the disease almost entirely disappear, and as a result the patient will show neither the physical signs nor the clinical symptoms of tuberculosis. Such a patient is in a condition somewhat similar to one under treatment by artificial pneumothorax. The case may seem to be apparently arrested, when in reality the lesion is not healed, but is merely collapsed. This collapse of the tissue favors the development of fibrosis and if the patient remains under treatment will very considerably hasten his cure, but if both the patient and the physician are deceived by the absence of physical signs and clinical symptoms, and the patient returns prematurely to the stresses and strains of ordinary life, there will be great danger of reactivation and relapse.

In advanced tuberculosis, the amount of tissue collapsed is likely to be so small a part of that involved in the active process that it makes but little difference in the general condition of the patient. In such cases the occurrence of the pneumothorax is likely to be signalized by chill and fever followed by several days' temperature and then a brief period of apparent improvement. In some of these cases, the pneumothorax is intermittent, alternately closing and opening.

The problem of diagnosis is not to determine whether there is a localized pneumothorax or not; if the patient has tuberculosis, it is most probable that the pleural surfaces enclose one or more small air pockets. The problem is to determine whether the collapse permitted by the air pockets which are present is sufficient in amount and of such location with reference to the tuberculous infiltration that it can materially modify the physical signs and clinical symptoms and course, and consequently the method of handling the case.

In the beginning of the study, both the clinician and the roentgenologist will recognize only the more obvious pneumothoraces, and neither one can advance rapidly in his study if unaided. With such mutual aid, the constant agreement of physical signs and x-ray appearances leads to finer and finer diagnosis until after several months both the clinician and the roentgenologist will easily detect the greater number of those which are present.

In two years' work with several thousand patients we have found that these small pneumothoraces occur only in tuberculosis. But tuberculosis in this sense is by no means always manifest tuberculosis. Tuberculosis at the hilus or near the interlobar septa, if at all active, usually reaches the pleura at some point whereupon it almost invariably produces a deepseated localized pneumothorax. The presence of a localized pneumothorax, therefore, indicates an active tuberculous process, which may be anything from an active central infection such as is ordinarily referred to as "latent tuberculosis," "hilus tuberculosis," a "pre-tuberculous stage," etc., up to and including far advanced and terminal phthisis. In general, then, a patient should not be told that he has tuberculosis (meaning manifest tuberculous disease) merely because a localized pneumothorax is detected upon physical examination or upon the x-ray plate. On the other hand, if a localized pneumothorax is found, the examiner may be entirely certain that there is an active tuberculous process present, that if the patient has had a manifest phthisis, he is still in danger of relapse, and that if the disease has not as yet reached the manifest stage, the patient's life should be so ordered as to prevent the development of consumption. We by no means imply that every case of tuberculous infection which shows a deepseated small pneumothorax will develop a manifest tuberculosis unless he is placed under treatment, but we have found no case either in children or adults which presented a small pneumothorax and which did not at the same time show unmistakable signs of illness and constitutional impairment, often slight and of limited duration.

While no doubt many, probably the majority, of such cases will recover without treatment, the percentage which ultimately develop a progressive pulmonary tuberculosis will certainly be considerably larger among such cases than among those which present only the entirely inactive and non-progressive infection which is evident only at autopsy.

We have carefully studied those of our patients who have been discharged from this or other hospitals as quiescent or apparently arrested, or who have felt so well that they have refused to remain longer under treatment, and who at later periods have returned to us with reactivation or relapse. We find that of these patients 82 per cent. have had localized pneumothoraces of such situation and extent that they cause partial or complete collapse of all parts of the lung showing any considerable tuberculous infiltration. It seems likely, therefore, that a thorough understanding of the effects of small pneumothorax will enable us to determine certain of the cases which are liable to relapse and which need to remain longer under treatment or observation.

While patients are still under treatment those who have a partially effective collapse from localized pneumothorax will show less moisture and fewer clinical symptoms than will patients with the same amount of involvement but who are not receiving the benefits of small pneumothoraces which are favorably situated with reference to lesions. This group of patients can easily be separated by physical examination and by the study of the x-ray plate and should receive a somewhat more rigid treatment than would seem to be indicated by the examination and by the clinical chart.

The size and position of the small pneumothoraces which may be present sometimes have an important bearing upon both the selection of cases for treatment by artificial pneumothorax and the administration of the general and special treatment.

The practical importance of a thorough understanding of the diagnosis and effect of small pneumothorax, is therefore sufficient to justify the months of attention and study which must be given toward it by the clinician and roentgenologist in collaboration before proficiency and certainty in diagnosis can be obtained. Numerous special applications of importance are given in our monograph. The more obvious and general ones are as follows:

1. The explanation of the absence of signs of moisture in cases which otherwise seem to have an active tuberculous lesion.

2. An explanation which enables the physician to understand certain of the vagaries in the course of tuberculosis which are otherwise inexplicable.

3. The determination of a certain number of cases which need more careful supervision than the same amount of clinical activity would ordinarily indicate.

4. The determination in advance of a certain proportion of the quiescent and apparently arrested cases which are particularly liable to relapse.

5. Assistance in the selection and in the treatment of certain of the cases which may be considered for treatment by artificial pneumothorax.

6. The division of the cases usually diagnosed neurasthenia, debility, autointoxication, etc., in other words cases of ill defined general illness into two classes, in one of which a tuberculous infection of slight extent or central location plays some part, and in the other of which there is probably no active tuberculous element whatever.

DISCUSSION ON PAPER BY DR. BARLOW AND DR. THOMPSON

Col. F. H. McKeon, Camp Kearny, Calif.: Naturally the service is greatly interested in the earnest conscientious work that these two of its officers have done. Personally, I am interested because I was associated with the essayists during the first year of the period of their observations.

Even admitting, as most of us will, that it is difficult to conceive that spontaneous pneumothoraces occur in the percentage of cases that the authors present to us, we must give due consideration to the undoubted existence of the partial spontaneous pneumothorax. One of our problems at present is to determine why a considerable percentage of men who were certified to the Federal Board for Vocational Education as being arrested cases of tuberculosis, are returned to us for further treatment because of having broken down under training.

We realize, of course, that the greater number of these men break down because they attempt to do what no person with a newly arrested case of tuberculosis can safely do, and that is to combine work and play. However, there are instances of breakdowns under training that can not be explained along these lines. Whether it be that our hardening process is not sufficient, or whether it be for some other reason, the fact remains. At the hospital where I am now stationed a man must have had five hours' daily exercise, two hours walking and three in vocational training, before he receives his discharge as an arrested case. In spite of this precaution, however, we have on record a few instances of reactivation after we believed that we had helped the patient to regain sufficient immunity to take up training safely. Now, if only one per cent. of all breakdowns found amongst service men under training occur because activity was disguised or hidden by a localized pneumothorax, the occurrence of this phenomenon in tuberculosis is surely something for us to study very carefully. The paper of today will undoubtedly stimulate such study, not only by service officers, but by others. So far as the service hospitals are concerned, it will be necessary to proceed with great caution to avoid the appearance of setting up a new standard of diagnosis.

Dr. David R. Lyman, Wallingford, Conn.: I happen to be a few miles away from Major Barlow and Dr. Thompson. I am free to confess that when they first started talking to me about the appearance of four or five local pneumothoraces in one patient, and followed it up with the suggestion of mediastinal pneumothorax as being the first sign of tuberculosis

possibly in some cases, well, if I didn't think they were plumb crazy I came pretty close to it. I just thought they were star-chasing entirely. I went down and spent a few days and worked over some of the cases with them, and worked over some of my own, and I was impressed with several things.

The first was that this work they have put forward is a painstaking work that has covered a long space of time, and the careful study of, I think, over a thousand cases, with the clinical study and x-ray plates, and they have here what we seldom or rarely get in our meetings, a brand new line of thought.

Now, I don't know whether they are going to be entirely right or not. If they are entirely right they are going to do to physical diagnosis what Mr. Einstein is doing to the rest of the world, but I am firmly convinced that a careful study of this report should be made by all of us when it comes out. It is going to take a year or two of real careful study by the men in tuberculosis work throughout the country to find how much truth and how much poetry are in it. Some of it looks poetic, but I know that in studying poetry I have often come upon some pretty good solid meat.

The other day when Dr. Dunham and Dr. Webb and Dr. Forster and I were all there together, we spent the whole day going over this work.

When we took a case and listened over it, and all of us got breath and voice sounds that to our minds have always indicated a cavity, and when the x-ray plate showed no sign of anything suggesting annular shadows or cavity but did show what they are talking of here as mediastinal pneumothorax, and which they explain as transmission of signs from the adjacent trachea, you can't throw their interpretation out of the window. They have given you something to study and work on.

There are two or three points of great importance to me. In studying localized pneumothoraces (excluding marginal ones) I have always looked for annular shadows. They have shown me that in interlobular pneumothoraces the chief sign I could get at first was the compression upwards of the upper lobe, and not a regular or annular line below, but an irregular line of compressed lung tissue to trace up.

Now, as long as the patient has a pneumothorax compressing the upper lobe, we have to go slow on the case until the pneumothorax is absorbed and we see whether the activity in the upper lobe is suspended or not. I think in prognosis that is a very important thing.

I think one thing they have shown to me, too, was that I had to take stereoscopic plates on every case that came in, no matter how bad the chest sounded, or whether I thought I didn't need x-rays to guide me in the handling of it: because, if you have a large pneumothorax instead of a cavity, you have a case to handle differently and handle more closely than I do, or than a good many of you do. I think that this is a thing that every man in tuberculosis work needs, and when this final report comes out, he ought to study it thoroughly and check it over for himself for the next year or two, and help these men get at what are the real facts. It will do at least one thing for you, as well as for me: It will wipe out a

whole lot of your careless clinical work and teach you something, whether or not at the end we tell them that the stars aren't there, and they only got part way. I think we are indebted to the Public Health Service for an original piece of research work that is going to be valuable, and may be immensely valuable.

Dr. Kennon Dunham, Cincinnati: When I was invited to come on and look over the work of my old comrade, Dr. Thompson, and my friend Dr. Barlow, I certainly came to scoff. Now, to come out and uureservedly say to you that I approve of all that Dr. Barlow and Dr. Thompson have done would be conceited on my part. I spent two full half days with them going over patients and plates, and they worked me as hard as they could, and I have not the slightest feeling that I reached farther than the first outer room. On the other hand, to damn this work by faint praise is the last thing that I wish to try to do.

Dr. Lyman has gone over some of the things that each of us saw in turn, looked over and checked up, and there is something unusual there. Colonel Bushnell preceded us, and found the same unusual thing, I think.

One of the most striking things has been the D'Espine sign. The D'Espine sign to me has been like a red rag to a bull. I understood it was due to the large lymph nodes, and I have tried to check it up with physical examination. I have utterly failed, because I have been looking for these lymph nodes or large hilum shadows or something else of that kind pressing, and I did not look, nor think of mediastinal pneumothorax. And when those things were demonstrated in the cases which they thought were localized pneumothoraces, and then they would show me the plates — not one, but serial stereoscopic plates — where the lung marks were farther away from the mediastinum, I could not help but believe, or at least hope, that we had found at last a rational explanation for some of these D'Espine signs.

I wish to congratulate the Public Health Service for encouraging this research work, and hope that they will go right ahead, whether it is right or wrong, trying to give us the truth, which seems to be suggested, so far. It would be a great mistake to have all of this work going on in the Public Health Service that has followed the work in the Army, and not to have us get some wonderful things out of it. Never before have we had en masse these large hospitals for tuberculosis, where a great many men were working.

Col. George E. Bushnell, Bedford, Mass.: I have not seen as much of Dr. Barlow's work in the way of physical diagnosis as Dr. Dunham has, but I have, perhaps, followed his work more closely, as far as the exposition of his views is concerned, and I am enormously impressed with the vastness of the work he has accomplished, and the great results he claims.

I am not prepared, of course, to endorse everything he says from my personal observation. That would be impossible. But I think this is either the most important contribution made to physical diagnosis, or it is a work

of the imagination. I don't believe it is the latter, because I have checked it up sufficiently to believe there is an objective reality in these signs. I have gone over the signs that Dr. Barlow found in what he considered to be pneumothorax, and while I do not know that the diagnosis is correct, I agree with him that they are an unusual group of localized signs, that they must mean something, and that in a general way they are correctly interpreted as signs; but the cause, of course, is still open to debate. At any rates those signs were not imagined by him. They existed, and I heard them as he did. I admire very much Dr. Barlow's enthusiasm and enormous industry, and extreme acuteness of observation.

The other day there were two or three papers on localized pneumothorax which I followed with great interest, and one fact struck me: not one of the writers said anything about the physical signs of localized pneumothorax. The diagnosis, in the case of Dr. Barlow's work, depends on the physical signs. We have got to admit, and I admit it with as much shame as anybody, that there must have been a local complex of physical signs in cases I have seen, which I overlooked, disregarded or misinterpreted. I know I have been careless in physical diagnosis, but I didn't think I had been as bad as I have — and as all the rest of you have!

I want to say one last word before I sit down, and that is this: that you must listen for fine points. Naturally, a series of signs like these do not stand out on the face of things. You have got to determine minute differences in quality of sounds and the like.

Dr. J. C. Foltz, New Haven, Conn.: I want you to recognize the importance of this diagnosis. I did not intend to speak on this subject, but I cannot lose the opportunity to bear witness that for two years I have been associated with these gentlemen and have watched their work. It is based upon not a few cases, but upon 2000. A few moments ago a roentgenologist here referred to plates that when taken went out of his possession and could not be referred to again. These gentlemen have a library of stereoscopic plates cross-filed for study, and the patients can be brought from the wards from time to time as symptoms may arise and be rephotographed.

A tremendous mass of material has been so studied, carefully and painstakingly, by two competent and skilled observers. I am absolutely convinced as to their conclusions and I wish to congratulate the gentlemen upon their successful demonstration.

In the post mortems I have made after these plates were taken I have found, as it were, test tubes of air where the pneumothoraces were seen, separated by delicate membranes of adhesions, into anterior, posterior, mediastinal and interlobar pockets.

When the completed article comes out I am quite sure its force will be appreciated. This, gentlemen, is the explanation of the "false recovery" spoken of by Laennec.

Dr. A. M. Forster, Colorado Springs: I can't help seizing on this occasion to say just a word about the situation in general up at New Haven Hospital. I had the honor of being connected with that hospital during the

time of the armistice, when we were stimulated by the enthusiasm that then existed, and we are all very proud of the spirit and organization that we had there. It was a real pleasure for me to go back the other day and see not only this particular phase of the work that is being done but the wonderful organization, both from the executive as well as the scientific side of that institution, and I want to say that not only in this work but in the work done in the surgical department, there is an opportunity to see unusual cases of surgical tuberculosis gathered together under the very best treatment that science affords. This is also true in other branches of the clinical and general work of that hospital. If the work of the Public Health Service were organized in the same way throughout the country then we would have every possible reason to be extremely proud and feel that we had carried on just as well as we were able to do under the peculiar circumstances during our time.

Chairman Miller: Major Barlow, will you close the discussion?

Major Barlow: I want to express our thanks to all of the gentlemen who have helped us in our work; their response to our appeal has been most noble. Colonel Bushnell gave unsparingly of his time and effort in order to clear up some of our difficulties. We have undertaken a work which seems more vast the further we go with it, and we ourselves scarcely know enough about it to report at this early date. It enters into every field of tuberculosis, and the mere report of our work of the last two years will probably require between two and three hundred pages; it is not yet completed. We are presenting it at this meeting as an appeal for aid. The subject is too big for us to finish unaided, and we are asking you gentlemen to help us. We want you to assist us in working this out. I can not answer the questions suggested in the discussions, it would take too long. We have done our best to answer all of these and others which suggested themselves to us, in our report, which will be of monographic size. I would like to emphasize that this is an appeal for aid, and that to such of you as can spare the time, we extend a cordial invitation to investigate some of our work at New Haven, and to assist us in working it out.

PHYSICAL AND CLINICAL VARIATIONS IN A STUDY OF SEVEN HUNDRED TUBERCULOUS YOUNG WOMEN — FROM THE RECORDS OF AREQUIPA SANATORIUM*

By Philip King Brown, M.D.

San Francisco

In a study of the earliest manifestations of tuberculous disease of the lungs a number of interesting facts have come to light, and other facts usually associated with advanced disease have orientated themselves clearly and seem worth recording.

The following points will be discussed:

1. Loss of weight at time of diagnosis and classification of cases.
2. Relatively bad prognosis in obese cases.
3. Occurrence of premenstrual rise in temperature from one to ten days.
4. Initial symptom noted by patient and brought out in history.
5. Possible sources of infection.
6. Relation of hemorrhages and blood spitting to menstruation.
   " " " " " " " season.
7. Time and frequency of hemorrhage.
8. Possible increase of hemorrhage in cases taking sun baths.

(1) Of our 700 cases just 500 were diagnosed positively as tuberculous for the first time:

272 being classified as first stage.
73 being classified as second stage.
145 being classified as third stage.

It is quite interesting to note in Table I that up to a loss of 15 pounds the percentage distributed throughout the three classes is practically the same if the patients are grouped in small divisions representing 5 to 10 pounds loss or no loss. If those who lost more than 15 pounds are grouped the same way, in divisions of 5 to 10 pounds, the classification is still marked by the striking fact that advanced disease is not necessarily associated with any more marked loss of weight than is the initial stage. The importance of this is obvious in making patients understand that extreme loss of weight is not necessarily associated with advanced dis-

* Read by title.

TABLE I.

Loss of Weight at Time of Entrance

	No loss	1–5 lbs.	6–14 lbs.	15–24 lbs.	25–34 lbs.	35 lbs. & over	Total
First stage	11	44	117	56	29	15	272
Second stage	5	11	27	24	5	1	73
Third stage	7	22	59	26	25	6	145

	No loss	1–5 lbs.	6–14 lbs.	15–24 lbs.	25–34 lbs.	35 lbs. & over
First stage	4 per cent	16.1 per cent	43 per cent	20.6 per cent	10.7 per cent	5.5 per cent
Second stage	6 "	15 "	36 "	32 "	6 "	1 "
Third stage	4.8 "	15.1 "	40.7 "	17.9 "	17.2 "	4 "

	No loss-5 lbs.	6–14 lbs.	15 lbs. & over	No loss–5 lbs.	6–14 lbs.	15 lbs. & over
First stage	55	117	100	20.2 per cent	43 per cent	36.8 per cent
Second stage	16	27	30	21.9 "	36 "	39 "
Third stage	29	59	57	20 "	40.7 "	39.1 "

ease and likewise that rapid gain in weight is not to be taken as a sign of cure. We have been much impressed with the use made of weight gains by advocates of many so-called cures, and the laity and many physicians have entirely erroneous ideas of the significance of such gains.

(2) The relatively bad prognosis in obese cases is shown in Table II. It is extraordinary how easily weight is put on most bad cases unless they are in a very advanced state. Gains of 40 pounds are not at all infrequent in cases with not the slightest chance of their becoming well. It has been our experience that neither excessive flesh nor gain in weight are measures of resistance in the human any more than in the hog, and yet it is an unfortunate fact that gain in weight is regarded as a strong evidence of decided improvement if not of cure.*

TABLE II.

Condition on Discharge of Cases Weighing Over 150 Pounds on Entrance and Remaining at Least 6 Months

	Apparently cured	Arrested	Improved	Unimproved	Worse	Total
First stage	2	8	3	1	1	15
Second stage	..	2	3	..	..	5
Third stage	..	..	4	6	..	10
Total	2	10	10	7	1	30

* Government inspection in large packing plants shows that over 93 per cent. of all hogs slaughtered have already contracted more or less extensive tuberculous infection chiefly in glands of the neck.

Infections are less well borne by the obese, who seem to suffer more than do others from the effects of bad tonsils and bad teeth.

(3) A rise in temperature of a degree or more above normal demands explanation, especially when it is continued for several days. It has been a matter of interest for us to observe (Table III) that from one to ten days before menstruation there is a rise of temperature of at least one degree in cases which are afebrile at other times. In view of the fact that the temperature is often taken for two or three days in order to determine the presence of fever, it is important to know that in women this temperature rise may have no significance if taken in the period of ten days before menstruation.

In a series of 495 afebrile cases of all three stages, a premenstrual rise occurred in single women in 55 per cent. of the cases. Among married

TABLE III.

Occurrence of a Premenstrual Rise in Temperature

Married Women	Premenstrual rise	Average duration of rise	Extreme variation	No rise
First stage	43	4.2 days	1–7	58
Second stage	17	4	1–7	20
Third stage	16	3.7	1–10	20
Total	76			98
Single women				
First stage	79	4.3	1–8	62
Second stage	21	3.3	1–10	12
Third stage	26	4	1–10	32
Total	126			106
Grand Total	202			214

women the rise was not as frequent and occurred only in 41 per cent.

Irregular menstruation was relatively more frequent in the married women, and amenorrhea was nearly six times more frequent among the married women.

(4) In inquiring with considerable care into the initial symptom noted by the patient, a space for which was provided in the history blanks, the importance of certain early symptoms was emphasized. (Table IV.) The statistical study of these initial symptoms shows them arranged under the various stages of the disease when it was first recognized as tuberculosis.

The striking fact that cold and cough or recurrent colds were reported in 40 per cent. of the cases puts more importance than ever upon the adage that a cold that lasts more than three weeks must be proved not to be tuberculosis. We must change the rule of the trial courts and regard all

such cases as guilty until proved innocent. If we could do any single piece of propaganda work that would materially assist in the early diagnosis of tuberculosis, it would be to hold our medical courts responsible for the carrying out of this law.

Our second most common symptom was weakness and ease of fatigue. This needs no further comment than to note the fact that so common a symptom escapes attention even when a patient insists that it is of long

TABLE IV.

Noted by Patient and Brought out in History

Symptom	Stages			Total	Order of frequency	Stages		
	I	II	III			I	II	III
Enlarged cervical glands	5	2	4	11	11	1.2 per cent	1.8 per cent	2. per cent
Loss of weight	18	4	15	37	4	4.5 "	3.5 "	7.4 "
Rapid pulse	1	0	0	1		.2 "	0 "	0 "
Cold and cough	151	43	80	274	1	37.5 "	38.0 "	39.6 "
Recurrent colds	11	2	1	14	1	2.7 "	1.8 "	.5 "
Cough and fever	4	1	3	8		1. "	.9 "	1.5 "
Pleurisy pain in chest	34	14	24	72	3	8.4 "	12.4 "	11.9 "
After influenza	15	1	8	24	5	3.7 "	.9 "	4. "
After pneumonia	5	4	5	14	8	1.2 "	3.5 "	2.5 "
Fever	2	1	4	7		.5 "	.9 "	2. "
Night sweats	4	0	4	8		1. "	0 "	2. "
Asthma and bronchitis	6	3	3	12	10	1.5 "	2.6 "	1.5 "
Blood spitting and hemorrhage	7	8	3	18	7	1.7 "	7. "	1.5 "
Weakness and fatigue	108	19	34	161	2	26.8 "	16.8 "	16.8 "
Gastric disturbance	11	3	5	19	6	2.7 "	2.6 "	2.5 "
Dyspnoea	2	1	2	5		.5 "	.9 "	1. "
Headache	3	0	1	4		.7 "	0 "	.5 "
Hoarseness	2	3	1	6		.5 "	2.6 "	.5 "
Weakness after childbirth	1	3	1	5		.2 "	2.6 "	.5 "
Chronic ear condition	4	0	0	4		1. "	0 "	0 "
Miscellaneous	9	1	4	14	9	2.2 "	.9 "	2. "
1st stage:								
Shot through lung								
Insomnia								
Pain in spine								
Pain in abdomen (2)								
Irritation in throat								
Discharge in eye								
Catarrh								
Pain in hip								
2nd stage:								
Swelling of abdomen								
3rd stage:								
Pain in abdomen								
Iritis								
TB. peritonitis								
TB. bone								
TOTAL	403	113	202	718				

duration. We believe this symptom to be one of the great causes of overturn in labor in the constant search for an easier job, and if taken seriously earlier in the game, many cases of slight tuberculosis would be discovered.

The third symptom is pleurisy and pain in the chest. Loss of weight was the fourth symptom, and then follow a long range of symptoms which were reported too few times to be of more than historic importance.

It is interesting that blood spitting was the initial symptom in only 18

of the 718 cases, and that night-sweats and fever occurred respectively in 8 and 7 of the total cases. As a consequence of pneumonia tuberculosis was observed 14 times, whereas it followed influenza 27 times. It is highly probable that influenza occurred many times more frequently than pneumonia, so that while influenza has been of importance as a predisposing cause its actual danger is not so great as is that of pneumonia.

(5) The possible sources of infection were studied in 606 cases of patients who came from family homes, or who had lived at least five years at home. Among these (Table V) there were found to be 280 cases of family contact with the disease. In 110 cases there was also a

TABLE V.

Possible Sources of Infection

Number of Cases Surveyed, 606

Family Contact		280
Mother	100	
Father	56	
Sister	68	
Brother	53	
Husband	3	
Outside Family		110
No Contact		341
Family Tendency—Collateral Branches		308
Dates of Contact:		
Under 5 years		16
Over 5 years		224
Continuous from infancy		36
No dates recorded		330

definite outside contact. There was no known contact in 341 cases. There was tuberculosis in collateral branches in 308 of the patients.

As to the age when the contact occurred figures are not satisfactory, but they show that the contact occurred before the sixth year in 16 cases; after the sixth in 224; continuous from infancy in 36 cases. It is impossible to draw deductions as to the influence of childhood infections in this group. Figures are given as recorded for what they are worth.

(6) It has long been thought, and in a number of cases is graphically illustrated, that spitting of blood was likely to occur with greater frequency during the menstrual period. It seemed a reasonable presumption, also, that reactivation and consequent danger of hemorrhage would be more frequent in the winter months when we have rain and the danger from colds and exposure is greater than in the continuously dry summer months. As a matter of fact both these presumptions are wrong. Hemorrhages occurred 38 times in summer and 36 times in winter. Blood spitting occurred 95 times in summer and 72 times in winter. It seems more reasonable to explain the summer frequency by the fact that

TABLE VI.

HEMORRHAGE AND BLOOD SPITTING

Time of Occurrence	Blood Spitting	Hemorrhage
Early (within 6 mos. of probable onset)	36	30
Late	104	57
Unknown	45	18
Total	245	105
Relation to Menses		
Within Menstrual Week	33	6
In Other Three-Fourths of Month	103	9
Unknown	97	90
Equally distributed	12	
Total	245	105
Seasons		
Winter (Nov. 1 to Apr. 30)	72*	36
Summer (May 1 to Oct. 31)	95	38
Equal winter and summer	31	8
Unknown	47	23
Total	245	105
Frequency		
Single	71	53
Multiple	24	2
Not stated in history	150	50
Total	245	105
Cases Taking Sun Bath, 55	28	5
Occurring on day of bath	3	0
Not occurring on day of bath	25	5

patients are apt to take more exercise at that time, and that in a climate like ours where the greatest temperature change is from the middle of the day to the middle of the night, and not from summer to winter, the patients are more apt to dress unwisely in summer and are in consequence more apt to catch cold.

In estimating the relation to menstruation the menstrual week was taken as a unit. If menstruation were three days long the week was considered from the two days prior to menstruation through the two days afterwards. This week was called one-fourth of a month. It will be observed that blood spitting occurred just one-fourth as frequently during menstrual week; that hemorrhages occurred while patients were in the

*NOTE—8 had more hemorrhages in winter; 11 had more hemorrhages in summer.

sanatorium six times in the menstrual week to nine times in the other three-fourths of the month. In a large number of cases (90), the hemorrhage occurred before entrance and no accurate information could be collected as to what its relation was to menstruation. The known cases were too few from which to draw any deductions.

(7) The time of occurrence of hemorrhages in relation to the onset and duration of the disease was interesting, and the figures as shown can be safely interpreted to indicate that the majority of cases that have hemorrhages at all have them within the first six months of the disease. This is inferred on the ground that of the 105 cases reporting hemorrhages it is not possible to determine from the history when 50 of these hemorrhages occurred, but 53 of the remaining 55 were single hemorrhages and only three multiple.

(8) Exposure of the body to sun was tried over a period of eight months in 55 cases. Five of these had hemorrhages, and 28 spat blood. This fact was one of the things that convinced us that even with great care and conservatism in cases which had come to a standstill in their progress, hemorrhages occurred in five cases who had previously had none. Blood spitting occurred for the first time in over ten per cent. of the cases in whom it occurred at all. It may be of importance to add that in no case of pulmonary disease could we state that any benefit followed as a result of either heliotherapy or the use of the sun lamp.

THE TAKING OF TEMPERATURE IN THE DIAGNOSIS AND TREATMENT OF TUBERCULOSIS

By George Thomas Palmer, M.D.

Springfield, Ill.

Regardless of our rather brilliant progress during the past decade or two, it must be admitted that, from time to time, our record of accomplishment in the diagnosis and treatment of tuberculosis is very definitely challenged. It has more than once been intimated that, with our ultra-refinements of diagnosis, we are filling our institutions with persons who are not clinically sick and are branding as tuberculous many who, at most, present evidence of nothing more than old and quiescent processes. It has been contended that our cures do not remain cured; that our arrested cases do not remain arrested. There is some open skepticism as to the wearing qualities of our finished product.

While it is true that the record of recoveries is infinitely better than it has ever been before and while we know that hundreds of errors occur in negative diagnosis of tuberculosis to one error in positive diagnosis, there is still sufficient justification for criticism and question to warrant our painstaking scrutiny of our records and of our methods. Errors in diagnosis are far too frequent and reactivation of cases, dismissed as arrested, are far too common to warrant any degree of self-satisfaction on the part of tuberculosis specialists and institutional heads.

We may attribute part of our unsatisfactory results to the newness and undeveloped state of tuberculosis work; to our lack of knowledge of exact diagnostic and therapeutic procedures; to the general neglect of tuberculosis in the past by medical colleges and medical organizations; but, having purged our consciences and relieved our sense of responsibility as far as possible in this way, we must still face the fact that many of our errors are due to our own carelessness and our own short-comings and to our failure to employ intelligently the relatively simple procedures which we already have at hand.

During the past year, it has been my privilege to visit and study more or less carefully, public and private sanatoria having a capacity of upward of 4000 beds, scattered over an area extending from Indiana to California, and, as a result of these studies, I am forced to the conclusion that our unfortunate results are due in large measure to inaccuracy and neglect of very simple things and to no single factor so much as to the faulty taking and recording of temperature.

In all of these sanatoria, as is true in the private practice of physicians,

temperature is regarded as the most important single procedure in both diagnosis and treatment. In many cases, when we have exhausted all of our diagnostic resources without convincing results, the patient is placed under prolonged temperature observation to elicit our final and conclusive evidence.

With the diagnosis made, temperature is the determining factor in the classification of patients; in measuring the amount of rest and exercise; in prescribing the character and extent of occupational therapy; in regulating the administration of tuberculins, vaccines and other specific medication, and, finally, in settling the most important of all questions — the quiescence and arrest of the process and the discharge of the patient. In spite of all this, I believe that I am justified in saying, — if one may judge by the practice of a score of widely scattered public and private sanatoria of the better sort, — that eighty per cent. of tuberculous patients under medical care are handled and discharged without definite knowledge as to whether they are febrile or afebrile. If this rather sweeping assertion can be substantiated, the large number of reactivations after discharge should not be regarded with any degree of surprise; but should be looked upon as the result naturally to be expected.

The causes for this serious and somewhat startling condition of affairs seems to be: (1) The employment of cheap and undependable thermometers; (2) Lack of knowledge on the part of nurses and attendants as to the basic principles of temperature taking; (3) Permitting patients to take their own temperatures; (4) Insufficient time in taking temperatures; (5) Infrequency of readings and the selection of improper times of day for such readings, and (6) Failure to determine the temperature reaction to varying amounts of exercise and exertion.

During the war, and until quite recently, the thermometers of even the better class of makers were somewhat below standard on account of the rush of manufacture and the shortage of seasoned glass. At the present time, however, entirely dependable thermometers may be obtained, although the market is still flooded with instruments which are entirely unreliable and have only cheapness in price to commend them. Unfortunately there is no governmental control or standardization of thermometers except in the states of Massachusetts and New York, the certificates accompanying thermometers depending for their reliability entirely upon the responsibility of the manufacturer.

It was found, in several of the sanatoria, that thermometers were purchased without regard to the reputation of the maker and, in some instances, the institutional heads had no idea as to their source. With such disregard as to character of important instruments of precision, accuracy is hardly to be expected. Even with thermometers of reliable manufacture, the conscientious clinician will see that his instruments are tested in practical use before they are accepted. This was rarely if ever done in the sanatoria visited.

Casual observation of patients during temperature taking indicated that it is not customary, in the average institution, to instruct the patient

as to how the thermometer is to be employed or the causes of failure to obtain accurate results. The nurses and attendants who were questioned were in many instances unable to explain intelligently the simple underlying principles of temperature taking such as the effect of outside temperature, the necessity for close coaptation of the tongue and buccal mucous membranes to the thermometer bulb and so on. Without regard to these factors, the custom prevails of placing the thermometer in the mouth of the patient for a given time and that period of time usually far too short for average conditions.

It is contended by reliable thermometer makers that their instruments will register accurately in one or two minutes, provided they are properly used; but it is safe to say that there is no thermometer, however accurate, which will give dependable temperature in one minute, two minutes or three minutes as employed in the average sanatorium.

In a number of the sanatoria visited, the thermometer was permitted to remain in the mouth of the patient for but one minute. In others, two minutes was the accepted time and in institutions housing 3200, or eighty per cent. of the 4000 patients, the period allowed for temperature taking varied from one to three minutes. A period of five minutes was exceedingly rare and of ten minutes almost unheard of.

To prove out the dependability of temperatures taken at short periods, groups of patients have been selected in my own two sanatoria and in several other public and private institutions, in none of which was the purpose of the study confided to the nurses, the only admonition being that the temperature be taken with the utmost accuracy and that the timing be very exact. With a total of about 200 patients, it was found that the temperature is almost invariably higher at two minutes than at one; usually higher at three minutes than at two; frequently higher at five minutes than at three and occasionally higher at ten minutes than at five.

In a group of patients showing subnormal temperature at one minute, 25 per cent. were normal or above normal in two minutes; 38 per cent. above normal at three minutes; 50 per cent. normal or above normal in five minutes and 90 per cent. normal or above normal in ten minutes. Sub-normal temperature is, of course, of considerable significance in tuberculosis, in the opinion of some writers as significant as elevated temperature; but in this group of patients having sub-normal temperature at one minute, 40 per cent. were exactly normal in ten minutes while 50 per cent. were above normal. The difference between one and ten-minute readings varied from 1 to 2.6 degrees.

In a second group, where the temperature was normal or above normal at one minute, the same differences appear, the increase from one to ten minutes ranging from .6 to 3.4 degrees.

In one case, the patient showing normal temperature at one minute, two minutes and three minutes, was found to have a temperature of 99.6 at five minutes, 100 at ten minutes. In another, the patient with normal temperature at one minute was found to have a temperature of

100 at two minutes; 100.8 at three minutes and 102 at five minutes. In another, a patient with a temperature of 100 at one minute and 100.8 at two minutes, was found to have a temperature of 102.2 at five minutes.

In the first of these cases, on one, two and three minute readings, the patient would have been regarded as having normal temperature and, in the absence of any other contra-indications, would have been permitted to exercise, while we find, on five and ten-minute readings, a temperature which any cautious physician would regard as a definite indication for absolute rest.

This series of observations will be carried further, but it has been carried far enough to justify the assertion that, in the majority of cases in sanatorium practice, the attending physician does not actually know whether patients are febrile or afebrile and, what is true of institutions of the better class, is quite as true in private practice where the opportunity for close observation of the patient does not exist.

Other causes of failure to know the temperature range of the patient are in infrequency of readings and the unfortunate selection of the time of day for temperature taking. In practically all of the sanatoria visited, temperatures were taken only twice daily, and this was true in even the receiving and discharging wards. In fact, in some of the larger sanatoria, temperatures were taken only once a day and, in one of them, only once a week in the ambulatory wards.

In several of those institutions in which two daily temperatures were taken, one reading was made early in the afternoon and the other at about nine o'clock in the morning. A temperature reading before breakfast and before the teeth are brushed or before any hot or cold food is taken, is of genuine worth, giving us usually the daily minimum which has definite significance; but a nine o'clock morning temperature, in my opinion, is of so little value as hardly to justify the effort.

Thus it is noted that in sanatoria housing 75 to 80 per cent. of this 4000 patients, reliance, in reality, is placed upon one temperature a day, made, as a rule at about two o'clock in the afternoon. This one afternoon reading will usually show the existence of elevated temperature; but the exceptions to the rule are so frequent and the knowledge as to the exact temperature so important as to make a single temperature reading dangerously undependable. It is in relying upon a single afternoon temperature that the physician in private practice very frequently overlooks most important diagnostic information.

It was also observed in many of these sanatoria that, while temperatures were frequently taken in the infirmary wards, where there was really little doubt as to the serious illness of the patient, infrequent and careless temperature taking was the rule in the receiving wards and, particularly, in those wards occupied by patients under observation for discharge. This fact alone may account for numerous inaccuracies in diagnosis on the reception of the patient and for the frequent reactivations of cases discharged as quiescent or arrested.

It is essential to sound and safe practice that temperatures should be

properly taken at very frequent intervals in the receiving and diagnostic wards and that every patient considered for discharge should undergo frequent temperature tests at rest and after varying degrees of exercise, extending over a period of a week or ten days. Unless it is known that the patient is running a normal temperature twenty-four hours in the day and is capable of prolonged and vigorous exercise without temperature reaction, his discharge as arrested or quiescent is wholly unjustifiable.

In certain sanatoria, it was found that the patients were permitted to take their own temperatures — a practice which is mentioned only to be condemned. The results of this practice, even when conscientiously carried out by the average patient, were found to be undependable, and in two institutions it was definitely proved that the patients deliberately falsified their temperatures to avoid restrictions of their recreation and liberty. Aside from the absolute unreliability of temperatures taken by the patient, it is my experience that certain nervous and apprehensive patients are distinctly harmed by a knowledge of their temperature curves and it is my own practice not only to have all temperatures taken by nurses or experienced attendants, but to withhold the knowledge of the temperature from the patient, particularly during the active stages of the disease.

I fully appreciate that this treatment of the subject is extremely elementary and that the facts set forth are generally known to the medical profession. In view of the importance of the temperature in diagnosis and treatment, however, and especially in view of the very general disregard for its proper observation in representative sanatoria, I feel that these remarks may be presented even to this group of physicians without apology.

DISCUSSION ON PAPER BY DR. PALMER

Dr. A. M. Forster, Colorado Springs: I think Dr. Palmer has done a real service in calling attention to this subject of more care in temperature taking. We are always so ready to accept what is told us that many of us have neglected to verify the statements of the thermometer makers that a particular thermometer is a one minute, two minute or three minute thermometer.

I think that some of the trouble is also due to the fact that the average doctor wants to know whether a patient has a fever or not, and to a large number of doctors fever means something over 99½. Yet, we know in tuberculosis that a temperature under 99½ is of more importance in handling our cases, than that above. The variation of one-tenth or one-fifth, we have long known, those of us working with tuberculosis, is of great significance.

I was much impressed the other day, in Boston, to hear a man who stands high in internal medicine, calling attention to the necessity for watching for those little variations of temperature in other diseases besides

tuberculosis. It was a sign to me of improvement in the detail of care of any condition. It is certainly very true that with the ordinary method as given by the thermometer makers, we are going to fall into the habit of overlooking conditions which require very definite attention. I would even go further than Dr. Palmer, and say that in the winter time, with patients out-of-doors, it may be well to keep the thermometer in for ten or even fifteen minutes. By keeping the thermometer in for ten instead of one or two minutes, I have seen a thermometer register higher. The thermometer is not going to register any higher temperature than a patient has. Consequently, I think we ought to work out the length of time that is actually required for temperature taking.

Dr. Palmer speaks of his study, and I think it would be opportune in view of what he already has done, to make careful comparison as to his results with both mouth and rectal temperature. There are some engaged in tuberculosis work who depend on rectal, and some on mouth temperature. There has not been extensive enough work done to give us the accurate information as to which is the more dependable. In my own experience, I feel that mouth temperature, if taken as Dr. Palmer suggests, is more dependable and gives a better idea of the changes in temperature due to the tuberculosis, than does the rectal temperature. In other words, the rectal temperature varies much more quickly, is much more sensitive to effect of digestion and of exercise than the mouth temperature is. I think, in view of what Dr. Palmer has already done, that he might well include some work on that phase of the temperature question also.

Dr. S. A. Knopf, New York: I listened with interest to the doctor's remarks and only venture to suggest a little method which may help in the determination of the exact mouth temperature. To the inexperienced, it may be surprising that at times when pulse and skin indicate a feverish condition, the thermometer in the mouth does not rise at all or only to a relatively insignificant degree. The reason for this is simply that the lips of the patient are chapped and the cold air from outside passing through the cracks, cools the thermometer. My venerable friend and teacher, the late Prof. A. Jacobi, taught me that in such cases one should tell the patient to moisten his lips thoroughly and thus obtain a tighter contact around the thermometer which will then register more accurately.

Frank Hayden, Rutherford, N. J.: I consider it a privilege to say a word on this subject because of my familiarity with it from the standpoint of the maker of clinical thermometers.

I want to make a statement which, I am confident, will be startling to practically all of you, and that is that any clinical thermometer properly made will arrive at its maximum registration under proper conditions of exposure, or contact, within thirty seconds. I do not make this statement in defense of thermometers, but do make it as an actual fact, borne out by scientific research and experiment, and present it to you as a problem for you who are actively engaged in the taking of temperatures, to solve.

By "proper contact" I mean that every individual part of the mercury bulb of a clinical thermometer should be evenly and equally covered at

the same time. This may be a physical impossibility in the human body, but I believe it is one of the matters that you may well consider. This is one of the reasons why so many people feel that a more prompt and accurate registration is obtained by rectal rather than oral exposure.

I feel confident that Dr. Palmer's paper, considered with this statement, which can be readily proven by the records of reliable clinical thermometer manufacturers, will lead many of you to review carefully the technique of your temperature taking.

THE SAFE REMOVAL OF TONSILS BY THE DESICCATION METHOD WITH THE HIGH FREQUENCY CURRENT IN POOR SURGICAL RISKS, WITH ESPECIAL REFERENCE TO THE TUBERCULOUS

By P. P. McCain, M.D.

Sanatorium, N. C.

Diseased tonsils quite frequently play an important rôle in impeding the tuberculous patient's progress toward recovery. The employment of the usual surgical methods for their removal, which is comparatively safe for the otherwise healthy patient, entails rather serious risks for the tuberculous. The mental strain, the loss of blood during the operation and the marked soreness, preventing as it does the taking of food for several days, are necessary evils of the surgical operation which often materially lower the patient's vitality. When we consider the fact, too, that rather serious complications may occur, such as pulmonary abscess, secondary hemorrhage, pneumonia, embolism and infection, the danger of the surgical operation for the tuberculous patient is all the more real.

Unfortunately the tonsils of the tuberculous are equally, if not more, subject to the ordinary diseases and in addition are much more frequently than others the seat of tuberculous lesions either active or latent. Weller[1] states that the histological examination of material from 8697 consecutive tonsillectomies at the University of Michigan showed active tuberculosis in 2.35 per cent. Ballenger[2] states that various writers report from 4 to 10 per cent. of tonsils removed for all causes as showing local tuberculous lesions. Wood[3] reports the tonsils involved in 88 per cent. of 43 of his own cases of tuberculosis coming to autopsy and in 69 per cent. of 167 tuberculous patients reported by seven other investigators.

The presence of tubercles in tonsils constitute an additional element of danger for their surgical removal because of the possibility of disseminating the infection. The necessary trauma and the gaping blood vessels of the peritonsillar tissue make such an eventuality not improbable. In cases of active tuberculous ulceration the danger is so real as to constitute a contraindication to the ordinary tonsillectomy. Yet if such a tonsil is not removed, the patient soon becomes the victim of tuberculosis of the pharynx and the neighboring structures, which is the most to be dreaded of all the complications.

It was such a dilemma as this which occasioned our learning of the use of the high frequency current in the removal of tonsils. A recent graduate of one of the best medical colleges in Philadelphia, who had been a former patient of ours, had an exacerbation of his trouble while taking his interneship in one of the large hospitals in the same city. He returned to us with active symptoms, tubercle bacilli in his sputum and an ulcerated left tonsil, only the shell of which was left. We felt that surgery was contraindicated, but thought there was a possibility of relief through cauterization, and sent him back to consult his professor of diseases of the nose and throat. After confirming the diagnosis of tuberculosis of the tonsil by removing a small section for microscopical examination, the latter sent him to Dr. William L. Clark, of Philadelphia, who removed the tonsil by the desiccation method with the high frequency current. After two weeks he returned with no sign of any tuberculous process in his throat, his active symptoms disappeared, and at the end of two months he went on our staff and continued doing regular work with no return of symptoms.

We secured a high frequency machine and have used the method over a period of four years in 32 cases. In 1918 Clark[4] reported his results in over 50 cases, and our experience coincides with that as stated by him: "The desiccation method may be depended upon to fulfill every requirement, viz: sterilization, complete or partial removal of tonsils without surgical shock, hemorrhage, or great immediate or after discomfort to the patient and with no resulting contracted cicatrix or danger of impairment of phonation." This is the only method which is at all safe for the removal of ulcerated tuberculous tonsils, and it is not only safe in such cases, but where the process is limited to the tonsils themselves it can practically always effect a cure.

Oftentimes it is not necessary to remove a whole tonsil, for frequently the source of the trouble comes from the retained infected material in only a few of the crypts. This is most commonly true in the crypts opening into the supratonsillar fossa and at the base of the posterior pillar, where the tonsil is capped over by folds of mucous membrane which may hug so tightly as to close the mouths of the crypts. By the desiccation method it is a comparatively simple matter to destroy enough of the tonsil to establish free drainage of these crypts; and in case the morbid local and general processes do not subside following this, the remainder of the tonsil may be removed at a later date. This has the double advantage of conserving all healthy tonsillar tissue for any useful purpose it may serve and of causing the least possible inconvenience to the patient from the operation.

The only special equipment needed is a standard high frequency machine, a fulguration handle with suitable electrodes and a foot switch, all of which can be had with an outlay of about two hundred dollars, or perhaps less. It is the mono-polar Oudin current which is employed. We use the little aluminum wire electrodes insulated with rubber tubing. The aluminum permits bending of the tip of the electrode to any desired

angle so that any part of the tonsil may be reached. The foot switch is essential in order that the current may be turned off instantly when necessary.

The destruction of the tissues is accomplished by sparks from the electrode which cause dehydration or desiccation. The tip of the electrode should be held in contact with the tonsil since any air space will prevent penetration. The current should not be strong enough to cauterize. The destruction may be carried to any depth desired, and either one or both tonsils may be removed at one sitting. The best results, however, can be obtained by destroying the tissues to only a small depth at a sitting and allowing sufficient time between treatments for the destroyed tissues to come away. It usually requires two or three sittings, at intervals of five to seven days, to remove a tonsil completely. By following this procedure tuberculous patients have so little soreness following the operation that they do not have to miss a single meal, they are not confined to bed and they have but little if any fever.

We follow in the main the technique as described by Clark.[4] The operation is carried out with the patient sitting in a comfortable chair with a head rest. The only anesthetic ordinarily needed is a topical application of an eight to ten per cent. cocaine or novocain solution. Rarely in sensitive throats one-half to two per cent. novocain or procain injected only into the tonsil will be necessary in addition to the above to make the procedure painless. The reflexes are destroyed by an application of the solution to the pharynx and the neighboring structures. Several applications are made to the tonsils and a sufficient time is allowed for the drug to take effect, which is usually ten to twenty minutes. The tonsils are not very sensitive to pain, but the pillars, tongue and uvula are quite sensitive and great caution needs to be exercised to avoid touching them in applying the current. This was the source of error in the few cases which have suffered any degree of pain or had more than a slight amount of secondary inflammation following the operation. The tongue is kept out of the way by using a rather large tongue depressor, which is held, after being placed in the desired position, by the patient himself. This is not only a convenience to the operator but it has also a helpful psychological effect on the patient. At the first sitting a pillar retractor is usually not necessary, but after the more prominent portion of the tonsil is removed, it is necessary to retract the anterior pillar in order that the part of the tonsil lying behind it may be brought into view for removal. For this purpose an instrument should be used the edges of which are smooth and rounded so that there will be a minimum amount of discomfort on traction.

Our experience has been limited to adults. Naturally the method is not applicable without a general anesthetic in young children. But it is my opinion that it could be used as in adults in a good many children of intelligence of seven or eight years or older. We have had occasion also to use it only in cases of tuberculosis. There is no reason, however, why it should not be used in any condition, such as cardiac and renal diseases,

the anemias and hemophilia, in which surgery is contra-indicated. The only disadvantages of the method are that it cannot be used in young children and that it requires more time and patience.

The results recently reported by Witherbee[5] through the use of the x-ray in causing atrophy and sterilization of diseased tonsils are so encouraging that the time may come when a tonsillectomy is rarely necessary. It will never be safe, however, to depend upon the x-ray alone in cases of active tuberculous ulceration of the tonsils. The desiccation method should be used for the removal of such tonsils. But even here the best results can probably be obtained through the combination of the two methods.

The desiccation method can be used best, of course, by a throat specialist, but it can be used safely and with good results by any physician who is careful and who knows the anatomy of the tonsil region. A knowledge of electricity is not necessary. The equipment for its use should be a part of the armamentarium of every sanatorium.

SUMMARY AND CONCLUSIONS

1. The surgical removal of tonsils entails rather serious risks for the tuberculous patient.

2. In cases of active tuberculous ulceration of the tonsil the additional risk of disseminating the infection is so great that surgery is contraindicated.

3. Tonsils, whether the seat of tuberculous lesions or not, can be removed without immediate or after bad results with the high frequency current.

4. The procedure is simple and the necessary equipment is not expensive.

5. The main disadvantage of the method is that it requires more time, since the best results are obtained by light applications of the current at several different sittings.

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DISCUSSION ON PAPER BY DR. McCAIN

Dr. Charles L. Minor, Asheville, N. C.: This is something that interests me a great deal. I have come to consider tonsillectomy a major operation fraught with many benefits, it is true, but also with great dangers. If

the methods reported to us can meet the situation, it will be a great blessing. I am not sure, however, that it can be used by anybody. I have done a great deal of laryngeal work, but I don't call myself a throat specialist, and I think a specialist ought to be able to do the thing better. However, if we can get rid of tonsils, tuberculous or not, in this way, quietly, without any great pain, without difficulty in swallowing, and especially if we can avoid what I have always considered the great danger of dissemination of tuberculosis or formation of pulmonary abscess, we are doing a very great deal.

As far as abscess of the lung is concerned, I don't think that is so important, because I am satisfied that if the doctor will operate his patient with local anaesthesia or with head down, the patient will not have an abscessed lung. An abscessed lung will not occur if the patient is conscious and can swallow or if his head is held down. But there is a large number of other cases in which this would be applicable.

I would like also to ask the Doctor whether the apparatus sparks loudly enough to frighten nervous patients, and how he determines when he has burned deep enough, and how much time is consumed.

Dr. S. A. Knopf, New York: I am sure we all are indebted to Dr. McCain's contribution. Those of us who have had the misfortune to have seen a number of lung abscesses following tonsillectomies will appreciate the valuable services which may be rendered to patients by the operation as performed by Dr. McCain. At the recent meeting of the American Medical Association in Boston, a physician attached to the Massachusetts General Hospital reported 75 per cent. of lung abscesses due to tonsillectomies in adults. For this reason I would strongly advocate the method of procedure outlined by the speaker. Everything possible must be done to avoid the dissemination of the tubercles. What I would like to have the speaker tell us is, whether he thinks general or local anesthesia is preferable in such cases.

Has he tried his procedure with the same success in children and does he not think the older process with the proper suction pump equally safe in such cases?

Dr. A. M. Forster, Colorado Springs: In connection with what has been said about an abscess following tonsillectomy, I believe it is well for us to remember that the total number of such cases has not been reported.

I feel tempted to speak of the method that I have used for quite a number of years, recognizing what Dr. McCain has said about the danger of tonsillectomy. I feel that I ought to speak of it before it is too late, because it is quite probable that this work that he is doing is going to supplant what we have done. In cases of chronic tonsilitis, particularly where there are the crypts containing infected matter, as Dr. McCain has described, I have had patients use gentle massage. The patient can be taught to do this just as we have to teach some of them to brush their teeth, and it is applicable to children too. I have found young children able to use it and get results. I have the patient use the forefinger, and gradually accustom himself to bearing it in the back of the mouth, and

then on into the pharnyx, and in the course of a week or two weeks at most, he is able to begin this general massage of the tonsil. They usually use the right hand for both tonsils. Some of them have used the right forefinger for the right and the left forefinger for the left tonsil, but it is surprising to note how quickly these large tonsils will begin to come down, and how the poisons will come out, and what definite clinical benefit you get from the use of this simple method.

Without detracting in the least from what this valuable method of Dr. McCain's has meant in our handling of tonsilitis in the tuberculous, still I feel that the method that I describe does have a place, and it may also have an important place in the handling of young children where we don't want to use tonsillectomy.

Dr. L. J. Moorman, Oklahoma City, Okla.: I have been impressed with three or four things in connection with tonsillectomy within the last few years. First, cases with quiescent or arrested tuberculous lesions are fanned into activity by the anesthetic and the strain of operation. Second, many cases with active tuberculosis, undiagnosed, are advised to have tonsils removed on account of the symptoms of toxemia. In such cases the tuberculous process is rendered more progressive and all symptoms aggravated. Third, the average individual will lose from five to ten pounds in weight within a few days if the tonsils are removed under a general anesthetic, and sometimes it takes many days to regain this weight. Under local anesthesia they seem to lose much less weight. I would like to ask Dr. McCain if he has checked closely his weight curves in connection with his work.

Chairman Miller: If there is no further discussion, I will ask Dr. McCain to close.

Dr. McCain: Some might take issue with Dr. Minor that there is practically no danger if the operator will lower the head of the patient during the operation. One author — I have forgotten his name for the time being — reports that as long as three days after the operation he has seen gaping blood vessels in the peritonsillar tissue, and it is the opinion of many that embolism plays an important part in causing abscesses of the lung. This obtains, of course, with local as well as with general anesthesia.

I agree most heartily with Dr. Minor that the operation should be performed by a specialist whenever possible. One who is thoroughly familiar with the anatomy and pathology of the tonsil and who is accustomed to using local anesthesia in this region can use the method to better advantage. In sanatoria, however, the services of a specialist are frequently not available. The method is so simple and the dangers are so slight that it can be safely used by any careful physician.

The question of the depth to which the destruction should be carried is to be determined almost entirely the first time or two the current is applied by the amount of discomfort which the patient experiences. When the tonsil is almost destroyed, care needs to be exercised not to go beyond the capsule; whenever in doubt stop and wait until the destroyed

tissue comes away and if the tonsil is not all destroyed apply the current again.

Dr. Minor: How do you know how deep you have gone?

Dr. McCain: You can tell by the blanching of the tissues. The difference between desiccation and cauterization is one of degree. Cauterization causes charring, and desiccation causes destruction of the tissue by dehydration.

Dr. Minor: Do you go a quarter of an inch?

Dr. McCain: Yes, or the whole tonsil may be removed at one sitting.

Dr. Minor: How long does it take?

Dr. McCain: As a rule only five or ten minutes after the anesthetic takes effect.

In regard to Dr. Knopf's question, I will say that we don't take children in our institution, and have not had occasion to use it with children. It could be used readily, I believe, by using ether, but it would be necessary to take the ether out of the room when you go to apply the sparks. There is no danger from the ether as it comes out of the lungs, and is exhaled. There is no danger there, and it could be used all right.

I am glad Dr. Forster mentioned his method of massage. It is useful.

One of the advantages of the method, as I mentioned in the paper, is that it doesn't cause the patient to miss any meals. At times we have made the applications immediately before a meal. The patient can eat without inconvenience, if the current is not applied too strong. Since there is so little discomfort and since he does not have to stop eating the patient rarely loses any weight.

Dr. Minor: How about the noise?

Dr. McCain: I imagine that would depend on the machine. There is necessarily a little bit of noise with any machine. It is not in the throat. The noise is over at your machine. You can put it as far away as you wish. There is practically no noise in the throat if the tip of the electrode is held in contact with the tissues.

Member: How long is the actual application, regardless of anesthesia?

Dr. McCain: It depends on how deep you carry it. I would say in ten or fifteen minutes you can take a whole tonsil out. It depends on how sensitive the patient's throat is, of course, but that is about the average length of time.

PATHOLOGICAL SECTION

Chairman

SIMON FLEXNER, M.D.

New York

Secretary

HAROLD L. AMOSS, M.D.

New York

FURTHER OBSERVATIONS ON HEREDITY AS INFLUENCING NATURAL RESISTANCE TO TUBERCULOSIS*

By Paul A. Lewis, M.D., and Sewall Wright, Ph.D.

Philadelphia

(Abstract)

Using guinea-pigs belonging to families subjected to continuous inbreeding until they are homozygous in the hereditary sense, and subsequent crosses between these strains, it has been definitely shown that resistance to tuberculosis depends in part on factors which are hereditary. The essential independence of these factors of other factors governing color, fertility, and general vigor, is indicated. Resistance to experimental tuberculosis in guinea-pigs is much more under the influence of these inherited, but undetermined, factors than it is under that of certain other factors also concerned, such as sex, age weight, etc. Adaptation of the above facts to laboratory work may, in time, seem to make experimentation with tuberculosis much more precise than it has been.

FUNDAMENTAL FEATURES OF THE COMPLEMENT DEVIATION REACTION AS APPLIED TO TUBERCULOSIS*

By Paul A. Lewis, M.D. and Joseph D. Aaronson, M.D.

Philadelphia

(Abstract)

Using a standard goat serum of high potency, the qualities of various antigens have been studied and the preparations have been in some measure standardized. An attempt has been made to apply the results to diagnostic work.

DISCUSSION ON PAPER BY DR. LEWIS AND DR. AARONSON

Dr. Augustus B. Wadsworth, Albany, N. Y.: I have followed for some time the splendid work on tuberculosis which Dr. Lewis has been doing in his laboratory, more particularly the work on complement fixation, because we have been working for four years along similar lines but with different methods. It has been most helpful and encouraging to feel that we are in sympathetic touch with his work and have in so many instances the support of his conclusions.

Unfortunately, the complement fixation test with the bacterial antigens has never been satisfactorily standardized. It was first developed by Bordet and Gengou in their studies on the typhoid bacillus, and Wassermann attempted to use it with the tubercle bacillus before he took up his work with syphilis which has been so successful. The specific nature of the reaction as it is now practiced in the diagnosis of syphilis is so obscure that the development of methods has been, and still is, largely empirical.

In nearly all the bacterial infections acquired immunity has been demonstrated without much difficulty, but in tuberculosis, despite careful study for many years, it is still obscure. In bacterial infection the bacterial cell enters the tissues, grows, and produces a poison which incites the disease reactions. We must therefore consider the parasitic activities of the micro-organism, its capacity for growth and its production of injurious substances. These activities vary in different infections. It is conceivable on the one hand that the bacterial cell might enter the tissues and grow without producing injurious substances, or inducing disease,— a harmless parasitism,— and on the other hand it is conceivable that a bacterial cell may not be able to penetrate the tissues but may produce powerful poisons on the surfaces of the body which are absorbed and induce the most serious reactions of disease. The tubercle bacillus, so far as we know, is predominantly a parasitic incitant of disease capable of growth in the tissues but often producing little or no febrile reaction. Nevertheless, at times the febrile reaction in tuberculosis is quite marked and recent studies suggest that this conservative reaction is an adaptive process, possibly the basis of some degree of acquired immunity.

In attempting to adjust the reaction for the diagnosis of tuberculosis, there are three fundamental questions to be answered: Is it possible to prepare specific antigens from the tubercle bacillus with which the complement fixation test can be accurately standardized? Is there an immune reaction in tuberculosis, the products of which will react specifically in the accurately standardized test? And finally, is the reaction of practical value in the diagnosis of tuberculosis?

The first part of our work was devoted to the preparation of antigens from the tubercle bacillus to determine the distribution of the antigenic properties in different fractions of the culture. The culture filtrate was separated from the bacilli and various extractions made. In order to

test the antigenic properties of these various preparations, it was necessary to obtain a standard immune serum. Attempts to do this in the rabbit and guinea-pig were not satisfactory, but with the horse we obtained a large quantity of immune serum which could be used as a standard. Specific complement fixing preperties have been demonstrated in the culture filtrates, in the fatty material extracted with ether, chloroform, carbon disulphide and carbon tetrachloride, in the aqueous and alcoholic extracts of the defatted residues after extraction with ether, chloroform, carbon disulphide and carbon tetrachloride in succession, and also in aqueous, glycerine, sodium chloride, sodium hydroxide and hydrochloric acid extracts of the washed and dried bacilli, but no specific complement fixing properties were demonstrated in residues after prolonged successive extraction with ether and alcohol. The specific complement fixing properties present in the culture filtrates or in the aqueous extracts of the bacilli were not removed by extraction of these preparations with chloroform.

The antigenic activity was not affected by boiling, but it was sensitive to the hydrogen ion concentration, being more active above pH 7 than below. In dialyzing experiments, using collodion membranes, the substances possessing antigenic activity were retained, indicating their colloidal character. As nearly every one has noted, the culture filtrates were often markedly anticomplementary, but further study of the complement inhibiting properties of the antigens showed that they were due largely to the excess of free hydrogen or OH ions, the presence of acid or basic diffusible salts (ampholytes), the presence of non-diffusible ampholytes and to the presence of precipitates. After removal of the free diffusible ions by dialysis or neutralization of their action by adjustment of the hydrogen ion concentration, culture filtrates and other preparations of the tubercle bacillus were no longer anticomplementary.

A careful study of the action of these substances with the standard serums of the immunized horse indicated that the specific antigenic activity of these different preparations was quite similar, varying only in degree, so far as we were able to ascertain. In order to purify and concentrate these antigenic properties, we adopted entirely new methods of adsorption and extraction which have been described in a preliminary communication.[1] After adsorption with charcoal, the antigenic action disappeared and could not be recovered. After adsorption on the euglobulin of horse serum, precipitation with carbon dioxide and extraction with alcohol, the precipitates were discarded and antigenic preparations in a greatly concentrated and purified form were obtained by evaporation of the alcohol and dispersion with aqueous solutions. Tests of these antigens, which are rich in lipoids, with serums which give complete fixation with the Wassermann antigen show that complement is fixed in about 20 per cent. of cases. The acetone insoluble fraction,

1. Wadsworth, A. B., and Maltaner, Frank: Purification and concentration of antigens for complement fixation by methods of dialysis, adsorption, and extraction. Jour. Exp. Med., 1921, 33: 119.

however, reacted with only 1 per cent. or less and without loss of antigenic properties when tested with the standard immune serum of the horse immunized with cultures of the tubercle bacillus.

Preliminary studies of these antigens with various immune serums from immunized and inoculated animals and from cases of human tuberculosis using a complement fixation test similar to that which is used in syphilis, soon convinced us of the necessity of restandardizing the method of testing the complement fixing property of these antigens so that the specific activity of serum could be very accurately measured and precise comparisons made of the action of normal serum with that of tuberculous infection. It was found necessary to determine the action of normal serum, mixtures of normal serum and antigen, the hydrogen ion concentration necessary for these reactions and for the hemolytic action of complement. In order to select the most active antigenic dose, it was necessary to adjust the hydrogen ion concentration of the antigens to between pH 7 and 8. In the test as we are now studying it, the largest quantity of serum which is not ordinarily anticomplementary is used, then one-half and one-quarter this quantity of serum is also tested in two additional series. A buffered salt solution is used to maintain the hydrogen ion concentration at pH 7.6. The smallest quantity of complement used is one unit. Graduated quantities of complement are used in six tubes up to approximately two and one-half units. The test is thus a serum titration in the presence of varying quantities of complement This test has enabled us to measure very accurately the activity of different immune serums from the immunized animal. We are now proceeding with the study of the activity of the serum of tuberculous animals in the course of infection, avoiding, so far as possible, the complication of immunization as the result of the inoculation. It has seemed to us wiser to study the development of specific immunity in animals before attempting to discover the practical value of the diagnostic reaction in human cases, in which it is often impossible to determine either the extent or the character of the infectious process. Our investigations have been conducted with three strains of the tubercle bacillus — a human virulent strain and the old nonvirulent Koch strain which has been under cultivation on artificial media many years, and a virulent bovine strain. The preparations from these different strains apparently possess similar complement fixing properties, although possibly the homologous preparation is slightly more active. Our attention is now directed to the study of bovine infection and also of the serum from selected human cases.

It is thus apparent that satisfactory antigens can be prepared from the tubercle bacillus and that they have a specific action with the serum of animals immunized with the tubercle bacillus, or with that of animals or human cases suffering from tuberculosis. It remains to determine the practical value of the test in the various stages of tuberculosis as it occurs in man.

S. A. Petroff, Trudeau, N. Y.: I would like to ask Dr. Lewis

whether the biological phenomena of iso-glutination have been studied in guinea pigs.

In regard to complement fixation, before I say a word in discussing the reaction itself, I will say that I do not agree with Dr. Lewis on antigens in regard to the antigenic properties in alcohol extract substance. Our work has proved that eighty-five per cent. of the antigenic properties is found in the protein faction, after tubercle bacilli has been pulverized in a grinding mill and extracted with toluol. Toluol extracts practically all the lipoids.

My personal belief is that neither protein, nor lipoids by itself can act as antigen, and that the best antigen is a combination of the lipoids and proteins of the tubercle bacilli.

Our experience is that the sheep develops a better titre of antibodies than the goat. One of our animals developed a serum which gave strong positive reaction in a dilution 1-50,000. At present we are mostly interested in, and concentrating all our efforts on the reaction itself.

There is one important factor which has been overlooked by most workers and that is the hydrogen-ion concentration in our system. You will recall the work of Sachs, who demonstrated the possibility of changing a positive Wassermann to a negative one, vice versa, by varying the hydrogen ion concentration.

I don't think complement fixation is practicable yet, and it is deplorable to see so many commercial laboratories making a lot of money.

Member: I disagree with Mr. Petroff in regard to the solubility of the antigen. It is soluble in alcohol, and if extraction is continued long enough the residue does not possess any antigenic properties. In addition to the substances mentioned by Dr. Wadsworth, we have also used butyl alcohol, since the work of Daykin demonstrated that certain amino acids were soluble in this substance.

We have secured our best serum from goats; of course, it depends a good deal on the animal. At the present time it is not quite as high as Dr. Petroff's, but it is half that strength — 1-20,000 of a cubic centimeter, I believe.

Dr. Wadsworth: In regard to alcohol extraction, we have not been able to get any antigenic preparation from the residue after alcohol extraction. When the alcohol extraction has not been carried to completion we have, but when carried to completion we have not been able to get any of the antigenic activity in the preparations.

Then it would seem as though the absorption of the antigenic substance on globulin and precipitation of the globulin bringing down the antigenic substance would free it from other substances. Finally, extraction and recovery of the antigenic substance from the globulin and the removal of the globulin by centrifugalization would indicate that the antigenic activity or substances carrying that activity are soluble in the alcohol or entirely taken up by the alcohol.

Dr. Petroff: I would like to know if the antigen, which is extracted

with alcohol, is lipoid in its nature. We know that up to the present time we have not been able to produce antibodies when lipoids are used as an antigen.

Dr. Wadsworth: I might say, in regard to the lipins, that we have found that these antigens, when they contained lipins in considerable quantity, reacted with the syphilitic serum like the Wassermann antigens, but when we removed them this action disappeared. They reacted with our standard tuberculosis serum quite as they did before the lipins were removed.

Dr. Lewis: To take Dr. Petroff's last point first, in closing this discussion, I think no one to-day would consider that because a substance was soluble in alcohol it was necessarily lipoidal or non-protein in its nature. In other words, that there are undoubtedly various substances related to proteins showing alcohol solubility and this old arbitrary distinction no longer has scientific importance. On the other hand, I agree with Dr. Wadsworth that the instances in which, after extraction with alcohol, you have a potent bacillary residue in the sense of something that will combine and fix with a complement in this reaction, are instances in which you have not carried your extraction with alcohol far enough. It has been my experience that it takes weeks to get the last traces of activity out of the residue with alcohol. Again results with cold alcohol are not comparable to those with hot alcohol.

Now, this means that with reference to the substances which are here involved, from a theoretical point of view we are merely on the threshold. We have not worked with the same methods, and none of us have compared thoroughly the methods of others. There is no particular point to-day in trying to be so very dogmatic as to what it all means.

As to Mr. Petroff's question relating to the variations in resistance in guinea-pigs, the question of grouping among these animals, as he expressed it, does not convey the significance which I intended to convey by the term "family." In other words, by crossing among these five families, one can produce other varieties of resistance so that there are no precisely limited number of groupings, in the sense that there are four groups in the human family based on agglutination of blood corpuscles.

Now, on the other question, as to the matter of iso-glutination among these various strains of guinea-pigs, we have not taken it up; and that leads me to say that we have not so far been able to consider any single factor, as regards its physiological nature, and that we regard this, from all points of view, as being the most important problem with which we are faced at the moment.

It is important in two general directions. In the first place, if we could discover the physiological nature of any one of these factors, it would be, perhaps, the first instance in which the physiological nature of any transmissible factor in heredity had been determined as concerning any infectious disease; and more than that, it might give us a clue as to what is the

nature of resistance in tuberculosis, in part at least. A thing which we would all like very much to know.

On the other hand, there is no clue as to what the nature of these factors may be, and it may take a prolonged and expensive and time-consuming study to go into that phase of the matter. All that we feel certain of to-day is that we have the basis for a more careful consideration, of any experimentation which we may be called upon to do in the future, than we have had in the past, which is in itself a certain accomplishment. And we have some slight evidence that heredity is a potent factor in resistance to tuberculosis, and one we must all reconsider, as to its value.

THE DESTRUCTION OF TUBERCLE BACILLI IN SEWAGE BY CHLORINE

By Jno. M. Conroy, M.D., Bernice Brastad Conroy, and Arthur T. Laird, M.D.

Nopeming, Minn.

Tests have been made from time to time of the effluent from the Imhoff tank at Nopeming Sanatorium, before and after treatment with chlorine, to determine the frequency with which tubercle bacilli are present in the effluent and the practicability of destroying them with chlorine.

A standard chlorinating machine such as is used in treating water is employed. The daily average amount of sewage is approximately 25,000 gallons. About two and one-half pounds of chlorine are used daily. This is equivalent to about 12 parts per million or six parts per million during the hours of the day when the flow is assumed to be twice the average. Samples were taken of the effluent as it came from the Imhoff tank before entering the chlorine mixing chamber, and again as it left the mixing chamber. The untreated effluent was diluted nine times with normal salt solution. The injections were made subcutaneously in the abdominal wall of a guinea pig. The treated samples were injected undiluted.

GUINEA-PIG INOCULATIONS

DATE	SOURCE	AMOUNT USED	DILUTION	RESULT	AUTOPSY
1917					
Nov. 14	Effluent from Imhoff tank treated with 11.2 parts of chlorine to 1,000,000 parts of effluent.	1 cc.	Undiluted.	—	No evidence of tuberculosis.
Nov. 14	Same as above.	1 cc.	Undiluted.	—	No evidence of tuberculosis.
Nov. 14	Untreated effluent.	1 cc.	1 part effluent diluted with 9 parts of normal salt solution.	+	Spleen enlarged and studded with tubercles. One mesenteric gland enlarged.
Nov. 14	Untreated effluent.	1 cc.	Diluted as above.	+	Abscess at site of injection. Spleen enlarged and spotted with tubercles. All mesenteric glands enlarged and caseated.

GUINEA-PIG INOCULATIONS — Continued

DATE	SOURCE	AMOUNT USED	DILUTION	RESULT	AUTOPSY
1917					
Nov. 26	Effluent chlorinated as above.	1 cc.	Undiluted.	—	No evidence of tuberculosis.
Nov. 26	Effluent chlorinated as above.	1 cc.	Undiluted.	—	No evidence of tuberculosis.
Nov. 27	Untreated effluent.	1 cc.	Diluted as above.	+	Spleen and mesenteric glands enlarged and caseated. Liver studded with tubercles. Mediastinal glands enlarged.
Nov. 27	Untreated effluent.	1 cc.	Diluted as above.	+	Abscess at site of injection, spleen enlarged and nodular. Liver studded with tubercles.
1918					
Jan. 11	Effluent chlorinated as above.	1 cc.	Undiluted.	—	No evidence of tuberculosis.
Jan. 11	Untreated effluent.	1 cc.	Diluted as above.	?	Spleen normal in size, congested. Liver shows occasional nodule.
Jan. 11	Effluent chlorinated as above.	1 cc.	Undiluted.	—	No evidence of tuberculosis.
Jan. 11	Untreated effluent.	1 cc.	Diluted as above.	+	Slightly enlarged lymphatic gland. Spleen nodular and studded with tubercles.
June 24	Effluent chlorinated as above.	1 cc.	Undiluted.	—	No evidence of tuberculosis.
June 24	Untreated effluent.	1 cc.	Diluted as above.	—	Inguinal gland much enlarged and abscessed. Spleen slightly enlarged.
Sept. 26	Effluent chlorinated as above.	1 cc.	Undiluted.	—	No evidence of tuberculosis.
1918					
Sept. 26	Untreated effluent.	1 cc.	Diluted as above.	+	L. inguinal gland slightly enlarged. Liver surface roughened and studded with tubercles.
Sept. 26	Effluent chlorinared as above.	1 cc.	Undiluted.	—	No evidence of tuberculosis.
Sept. 26	Untreated effluent	1 cc.	Diluted as above.	+	Spleen enlarged and studded with tubercles. Liver enlarged.
1919					
Sept. 19	Effluent chlorinated as above.	1 cc.	Undiluted.	—	No evidence of tuberculosis.
Sept. 19	Untreated effluent.	1 cc.	Diluted as above.	+	Spleen enlarged and studded with tubercles. Liver studded with tubercles.
Sept. 19	Effluent chlorinated as above.	1 cc.	Undiluted.	—	No evidence of tuberculosis.

GUINEA-PIG INOCULATIONS — Continued

DATE	SOURCE	AMOUNT USED	DILUTION	RESULT	AUTOPSY
1918 Sept. 19	Untreated effluent.	1 cc.	Diluted as above.	+	Spleen enlarged and studded with tubercles. Liver studded with tubercles.
Sept. 19	Effluent chlorinated as above.	1 cc.	Undiluted.	—	No evidence of tuberculosis.
Sept. 19	Effluent chlorinated as above.	1 cc.	Undiluted.	—	No evidence of tuberculosis.
1920 July 9	Effluent chlorinated as above.	1 cc.	Undiluted.	—	No evidence of tuberculosis.
July 9	Untreated effluent.	1 cc.	Diluted as above.	+	Spleen much enlarged and studded throughout with tubercles.
July 9	Effluent chlorinated as above.	1 cc.	Undiluted.	—	No evidence of tubercles.
July 9	Effluent chlorinated as above taken ten feet from outlet.	1 cc.	Undiluted.	—	No evidence of tuberculosis.
July 9	Effluent chlorinated as above.		Undiluted.	—	No evidence of tuberculosis.
July 9	Untreated effluent.	1 cc.	Diluted as above.	—	No evidence of tuberculosis.
July 9	Untreated effluent.	1 cc.	Diluted as above.	—	No evidence of tuberculosis.
July 13	Effluent chlorinated as above.	1 cc.	Undiluted.	—	No evidence of tuberculosis.
July 13	Effluent chlorinated as above taken ten feet from outlet.	1 cc.	Undiluted.	—	No evidence of tuberculosis.
July 13	Effluent chlorinated as above taken 100 feet from outlet.	1 cc.	Undiluted.	—	No evidence of tuberculosis.
July 13	Untreated effluent.	1 cc.	Diluted as above.	+	Spleen much enlarged and studded throughout with minute tubercles.
July 19	Effluent chlorinated as above.	1 cc.	Undiluted.	—	No evidence of tuberculosis.
1920 July 19	Effluent chlorinated as above taken ten feet from outlet.	1 cc.	Undiluted.	—	No evidence of tuberculosis.
July 19	Effluent chlorinated as above taken 100 feet from outlet.	1 cc.	Undiluted.	—	No evidence of tuberculosis.
July 19	Untreated effluent.	1 cc.	Diluted as above.	+	Spleen nodular and studded with tubercles. Liver and lungs show occasional tubercle.
July 19	Untreated effluent.	1 cc.	Diluted as above.	+	Localized abscess at the site of injection. Spleen enlarged, studded with tubercles. Smears show acid-fast bacilli.

GUINEA-PIG INOCULATIONS — Concluded

DATE	SOURCE	AMOUNT USED	DILUTION	RESULT	AUTOPSY
1920					
July 23	Effluent chlorinated as above.	1 cc.	Undiluted.	—	No evidence of tuberculosis.
July 23	Untreated effluent.	1 cc.	Diluted as above.	+	Spleen nodular studded with tubercles. Liver studded with tubercles.
July 23	Effluent chlorinated as above.	1 cc.	Undiluted.	—	No evidence of tuberculosis.
Aug. 9	Untreated effluent.	1 cc.	Diluted as above.	+	Localized abscess at side of injection. spleen enlarged and studded with tuber. cles. Smear contains bacilli.
Aug. 9	Effluent chlorinated as above.	1 cc.	Undiluted.	—	No evidence of tuberculosis.
Aug. 10	Untreated effluent.	1 cc.	Diluted as above.	+	Spleen enlarged and studded with tubercles. Liver studded with tubercles.
Aug. 31	Effluent chlorinated as above.	1 cc.	Undiluted.	—	No evidence of tuberculosis.
Aug. 31	Untreated effluent.	1 cc.	Diluted as above.	+	Localized abscess at site of injection. Acid-fast bacilli in smear. Spleen enlarged and studded with tubercles. Liver studded with tubercles.
Oct. 3	Effluent chlorinated as above.	1 cc.	Undiluted.	—	No evidence of tuberculosis.
Oct. 3	Untreated effluent.	1 cc.	Diluted as above.	+	Liver and spleen studded upon the surface and on section with tubercles.
Oct. 3	Effluent chlorinated as above.	1 cc.	Undiluted.	—	No evidence of tuberculosis.
Oct. 3	Effluent taken 100 ft. from tank, chlorinated as above.	1 cc.	Undiluted.	—	No evidence of tuberculosis.
1921					
Feb. 2	Untreated effluent.	1 cc.	Diluted as above.	+	Localized abscess at site of injection. Acid-fast bacilli in smear. Spleen enlarged studded with tuberculosis.
Feb. 2	Effluent chlorinated as above.	1 cc.	Undiluted.	—	No evidence of tuberculosis.

It will be noted that of the 24 guinea pigs inoculated with effluent untreated with chlorine 21 developed definite tuberculosis and that none of the 30 inoculated with effluent after the treatment with chlorine developed tuberculosis.

CONCLUSIONS

Sewage from a tuberculosis sanatorium nearly always contains living tubercle bacilli.

The use of a chlorine machine is a practical means of ridding the sewage of a sanatorium of tubercle bacilli.

Two machines should be installed to insure continued operation.

Preliminary treatment of the sewage is necessary to reduce it to a liquid form and to prevent the floating of solid particles containing tubercle bacilli in water courses.

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DISCUSSION ON PAPER BY DR. CONROY, MISS CONROY AND DR. LAIRD

Dr. Alfred Meyer, New York: Some years ago, at one of the annual meetings, I visited a sanatorium outside of Colorado Springs, I think, and the question was put to me by the superintendent of the institution, "What is the proper disposition of the garbage of the institution?" They were at that time feeding the pigs with the waste garbage of the institution.

Now, it seems to me that the question of the proper disposition of the garbage is very closely allied to the proper disposal of the fluid waste, and if anybody can give me any information as to practical observations of the danger of feeding domestic animals (I think we call the pig a domestic animal) in this way I should be glad to have it; also, what is the proper disposition to make, not only of the fluid waste, but of the garbage of sanatoria?

Dr. Lawrason Brown, Saranac Lake, N. Y.: I think the pigs do better at Stony Wold when given cooked garbage.

Dr. S. B. English, Glen Gardner, N. J.: We have been feeding hogs for ten years with garbage, five years with cooked and five years with uncooked, and we have had all of our hogs killed under inspection. We did find one animal at one time in which it was felt there was a tubercular abscess. That was during the first five years when the food was being cooked; but we have never had, following inspection, an animal condemned from garbage fed uncooked.

I would like to ask Dr. Laird about this sewage proposition. Do you have filter-beds? We have used chlorine for three or four years, but recently, on account of the difficulty that we were having in operating our machine, our state board of health said that we might do away with the chlorine, notwithstanding the fact that our final effluent was discharging into one of the headwaters of a big water supply. Since that time our sewage has been examined continually, and they have never been able to find live tubercle bacilli. We have a syphon chamber and filtration beds.

Dr. Laird: The chlorine is mixed with the effluent in a mixing chamber which the effluent enters immediately after leaving the Imhoff tank.

Dr. English: You don't have filter beds?

Dr. Laird: No, at the present time we have no other apparatus than the Imhoff tank, with its sludge bed, the mixing chamber and the chlorine machine.

We would be glad to learn whether the effluent from more elaborate sewage disposal plants contain tubercle bacilli. If your tests show that there are no tubercle bacilli in the effluent the plant would be efficient without the addition of the chlorinator. Our report before this section some years ago (Cincinnati Meeting, 1917), indicated that even somewhat elaborate sewage disposal works did not necessarily free the sewage from tubercle bacilli without the use of chlorine.

You can readily follow up the actual operation of your plant by inoculating guinea pigs with the effluent, which, after all, is a very simple matter.

THE SURVIVAL AND VIRULENCE OF TUBERCLE BACILLI IN EXCISED ANIMAL LYMPH NODES

(Further Studies)

By G. B. Webb, M.D., C. T. Ryder, M.D., and G. B. Gilbert, M.D.

Colorado Springs

About five years ago we began a series of experiments on the production of tuberculosis by transplants of tuberculous lymph nodes and other tissues. The first report on this research was made in 1918[1] and the main conclusion was as follows: that when tuberculous lymph nodes, or, for comparison, pieces of liver and spleen, are removed from tuberculous guinea pigs, and replanted under the skin in normal ones, and are retained, the bacilli thus transferred invariably produce a general tuberculosis, which differs in no apparent way from that which follows inoculation with free virulent bacilli.

Another phase of our earlier experiments dealt with the results of transplanting tuberculous nodes coated with collodion. When these were retained, they showed a progressive shrinkage by diffusion through the collodion membrane into the surrounding tissues of the host, until after several months nothing was left of the original node, of about 1 centimetre in diameter, but a minute mass about as big as a split pea, enveloped in a shrivelled collodion skin, and with its center solidly calcified.

In some cases large caseous collodion-coated nodes were planted in tuberculous animals, and this was followed by local inflammation and acute sickness, suggesting that the substances diffusing through the capsule were toxic to the tuberculous animal. But when the coated nodes were planted in normal animals the procedure was followed by no reaction, no altered sensitiveness to old tuberculin, no evidence of change in resistance to a subsequent tuberculous infection, and no lesions of tuberculosis.

In one instance, after the coated node had been retained for about two months, a small ulcer developed over it. We excised node and skin, and found that the capsule had broken, and there was free communication between its contents and the host's tissues. The pig was kept alive, and remained entirely free from disease, as did another pig inoculated with pus from the excised lesion. This suggested that the bacilli did not remain alive in these coated nodes,[2] as Heymans[3] has stated that they do when planted as an emulsion in pith capsules. Following this lead, we coated several nodes and kept them in normal salt solution in the incubator,

then after a few weeks we inoculated fresh pigs with the contents. These pigs also remained free from tuberculosis.

It now became necessary to determine whether there was something in the process of coating the nodes which killed the bacilli. We therefore undertook similar experiments with uncoated nodes. Guinea pigs were inoculated subcutaneously with virulent human tubercle bacilli, and when their inguinal nodes were grossly tuberculous the pigs were killed, and the nodes excised and placed in tubes of sterile salt solution in the incubator. At the same time an emulsion of tubercle bacilli was prepared in an exactly similar tube of salt solution, and placed with the other tubes in the incubator. At progressive intervals of time nodes were taken out of their tubes and cut in two. One-half was planted in a fresh pig, the

TABLE 1

GUINEA PIG NUMBER	GIVEN	TIME TISSUE OR EMULSION HAD BEEN IN INCUBATOR	RELATIVE NUMBER OF TUBERCLE BACILLI IN SECTIONS	CONTAMINATION OF TUBE	ABSCESS AFTER PLANT	TUBERCULOSIS OF HOST'S INGUINAL NODES FIRST NOTED	TIME ELAPSED BETWEEN PLANT OR INOCULATION AND AUTOPSY	TUBERCULOSIS AT AUTOPSY
		days				*days*	*weeks*	
I^{I}	Inguinal node		+++			15	8	+++
II^{I}	Emulsion					15	8	++
I^{II}	Inguinal node	15	+++	Staphylococci			17	
II^{II}	Emulsion	15				14	10	++
I^{III}	Inguinal node	29	+++	?	+		16	
II^{III}	Emulsion	29				10	4	+
I^{IV}	Inguinal node	43	+++	?			13	
II^{IV}	Emulsion	43				14	5	++

other half saved for microscopic sections, especially for examination as to the number and appearance of the tubercle bacilli present. At the same intervals, pigs were inoculated with the emulsion. The pig given a fresh node developed palpable tuberculosis of the inguinal nodes in 15 days. Those given nodes which had been 15, 29, and 43 days in the incubator developed no lesions. The pigs inoculated with emulsion which had been kept the same periods of time all became tuberculous in 10 to 15 days (table 1).

This first outline experiment was followed by another more extensive series, as a result of which we were able to conclude that the bacilli contained in the incubated nodes had completely lost all power to infect in seven days, and that the same change took place in tuberculous liver and spleen in three weeks or less. Experiments with these tissues at shorter time intervals are now in progress, and so far it appears that the results are the same as with the lymph nodes. The emulsion was still virulent

after 87 days (table 2). This loss of virulence was apparently due to the death of the bacilli, as cultures made from several of the tissues in question remained sterile, but we do not regard this point as absolutely estab-

TABLE 2

GUINEA PIG NUMBER	GIVEN	TIME TISSUE OR EMULSION HAD BEEN IN INCUBATOR	RELATIVE NUMBER OF TUBERCLE BACILLI IN SECTIONS	CONTAMINATION OF TUBE	ABSCESS AFTER PLANT	TUBERCULOSIS OF HOST'S INGUINAL NODES FIRST NOTED	TIME ELAPSED BETWEEN PLANT OR INOCULATION AND AUTOPSY	TUBERCULOSIS AT AUTOPSY
		days				*days*	*weeks*	
I	Inguinal node	2	+++	Staphylococci	+	19	9	++
II	Liver	2	+	?	+	43	9	+++
III	Emulsion	2				19	12	++
I^{i}	Inguinal node	7	++				12	
II^{i}	Inguinal node	7	++	Staphylococci	+		12	
III^{i}	Inguinal node	7	+++				16	
IV^{i}	Emulsion	65				20	3	+
I^{ii}	Inguinal node	11	+++				12	
I^{iii}	Spleen	23	+++				13	
II^{iii}	Inguinal node	23	++++	Staphylococco			12	
I^{iv}	Inguinal node	21	+++				5	
II^{iv}	Liver	21	+				13	
IV^{iv}	Salt solution from liver tube	21					15	
I^{v}	Inguinal node	30	Whole node planted—no sections				9	
II^{v}	Inguinal node	30	Whole node planted—no sections	Staphylococci	+		14	
III^{v}	Liver	30	Whole tissue planted—no sections				14	
IV^{v}	Salt solution from liver tube	30					15	
V^{v}	Emulsion	87				13	8	++

lished. It bore no relation to the presence or absence of contamination in the tubes. Several tubes became contaminated with staphylococci, and some of the nodes from these tubes caused local abscesses when planted, but the results as regards tuberculosis were the same as in the case of the nodes which remained uncontaminated. The nodes themselves are believed to have been in every case free from mixed infection during life.

The loss of virulence was not accompanied by any noticeable changes in the shape or staining reaction of the bacilli, though variations occurred, as they often do in fresh material. Nodes which had been incubated 21, 23, and even 43 days, showed large numbers of tubercle bacilli staining well with carbol-fuchsin, as appears in the tables, and the histologic picture of the tissues themselves showed remarkably little change in this time. Connective tissue, fat tissue, and endothelial cells in many cases were so well preserved that it would be impossible to assert they were not alive. Lymphocytes were somewhat less durable, and liver cells showed decided changes even at two days.

Moreover, the inert bacilli persisted and kept their normal morphology for a long time after planting in the new host. In one instance (I^{v}) a node planted after 30 days' incubation and removed at autopsy after 9 weeks in the new host, still showed many tubercle bacilli of normal appearance in the caseous areas, which had become partly calcified. The same was true, both as to bacilli and calcification, in another node planted after 43 days incubation and 13 weeks in the host guinea pig (1^{iv}). As a rule the planted tissue was mostly absorbed in a short time, and autopsy showed only a small brown area which on section consisted of large endothelial phagocytes containing fat and pigment. Sometimes tubercle bacilli were demonstrated in these cells (I^{iv}), which often coalesced to form giant cells of the foreign body type. The tissue reaction, that is to say, resembled that produced by any inert insoluble foreign material. The only changes noted in the regional nodes corresponded to those at the plant — slight to moderate infiltration with pigmented phagocytes. These phagocytes also carry some of the inert bacilli to the nodes, where we have sometimes detected them in small numbers. Neither at the plant nor in the regional nodes do we find the familiar cell pictures of tuberculosis.

We next did a third series to determine exactly when the loss of virulence occurs. In this series we planted nodes after incubation periods of 1, 2, 3, 4, 5, 6, and 9 days. Those of 1, 2, and 4 days produced disease; the lesions in the four-day host were slight as compared with the 1 and 2 day pigs, at autopsy after nine weeks, but this may have been a matter of dosage, since the node used on the fourth day was a very small one, while the others were large. However, in this pig there was distinct early calcification in connection with caseation in the regional (right inguinal and iliac) nodes. Similar calcification was observed in the spleen of pig II, which was given tuberculous liver incubated two days, and by biting at the incision produced a primary infection of his peritoneal cavity. We have since observed calcification as a result of inoculation with a very few free virulent bacilli. The 3, 5, 6, and 9 day nodes had not produced any

TABLES 3 A AND B

GUINEA PIG NUMBER	GIVEN	TIME TISSUE OR EMULSION HAD BEEN IN INCUBATOR	RELATIVE NUMBER OF TUBERCLE BACILLI IN SECTIONS	CONTAMINATION OF TUBE	ABSCESS AFTER PLANT	TUBERCULOSIS OF HOST'S INGUINAL NODES FIRST NOTED	TIME ELAPSED BETWEEN PLANT OR INOCULATION AND AUTOPSY	TUBERCULOSIS AT AUTOPSY
			A					
		days				*days*	*weeks*	
I^{VI}	Whole small inguinal node	1	No sections			23	9	++
II^{VI}	Half of large inguinal node	2	No sections			22	9	++
III^{VI}	Whole medium-sized inguinal node	3	No sections				9	
IV^{VI}	Whole small inguinal node	4	No sections			31	9	+
V^{VI}	Whole medium inguinal node	5	No sections				8	
VI^{VI}	Whole large inguinal node	6	No sections	?	+		8	
VII^{VI}	Whole large inguinal node	9	No sections				8	
			B					
III^{IV}	Half of crushed large caseous inguinal node	21	++	Staphylococci and putrefactive bacteria	+		14	
V^{IV}	Salt solution from tube of node III^{IV}	21		Staphylococci and putrefactive bacteria	+		13	
I^{VII}	Half of crushed large caseous inguinal node	35	No sections			21	5	++

visible tuberculous lesions when autopsy was performed after 8 to 9 weeks (table 3A). From these experiments it appears that vascular connections between the host's tissues and the planted node must develop in the first few days after the node is planted, somewhat sooner, that is, than we believed when we published our first report.

Finally, we cut open and crushed two large caseous nodes before incubating them, thus setting many bacilli free on the surfaces of the tissue and in the salt solution, in order to find out whether we were right in

believing that the loss of virulence was in some way a result of confinement of the bacilli in tissue. One of these became contaminated with organisms of putrefaction, and when planted after 21 days produced no tuberculosis. The other was not contaminated; it was planted after 35 day's incubation and produced manifest tuberculosis in the new host's inguinal nodes in 21 days (table 3B). No unbroken node incubated more than four days has caused tuberculosis in the new host in our experiments.

This prompt loss of virulence and apparent death of tubercle bacilli in tissue, without change in their appearance and staining, is at variance with many previous observations, which vary also among themselves. The following quotations illustrate the status of opinion on the subject.

Baldwin[4] writes:

> Putrefaction of sputum and tuberculous animal tissues usually destroys the tubercle bacilli within a few days (Baumgarten and Falk, de Toma, Schill and Fischer). It is dependent, however, on the nature of the process and how rapidly it takes place whether the products of decomposition are harmful to the bacillus or not. Galtier was able to infect animals after two months with putrid spleen and lung. . . . Cadeac and Mallet found buried tuberculous lungs virulent after five months, but Klein not after seven weeks.

Ravenel[5] cites the same authors and adds:

> Petri found that the tissues of a tuberculous rabbit remained virulent for three months and six days when buried in a zinc box but for only one month and five days when a wooden box was used. Galtier found that tuberculous tissues immersed in water *renewed from time to time* remained virulent for two months.

Calmette[6] adds, "Schottelius affirme que les bacilles restent vivants dans les cadavres de phtisques pendant plusieurs années."

As a result of our experiments we draw the following conclusions, which may serve to reconcile divergent views:

1. Tubercle bacilli enclosed in tuberculous tissue and kept in salt solution at body temperature, lose their virulence and probably die in a few days, regardless of whether contamination occurs or not.

2. Tubercle bacilli free in salt solution, or on the surfaces of crushed tissue, die in a short time when in close contact with certain types of putrefaction, but survive for a long time in the absence of putrefaction.

The most plausible explanation of these facts seems to be that the bacilli confined in slowly dying tissue, and the bacilli in intimate contact with putrefaction, which involves reduction, are deprived of oxygen, and soon die from this cause; while bacilli which receive the necessary minimum of oxygen survive for a long time. Such conditions of aeration may exist on the surfaces of putrefying tissues exposed to air, and even immersed in water "renewed from time to time" as in Galtier's experiment. However, we are not prepared to exclude some specific lethal effect of the tissue itself. In 1909 Fontes[7] reported experiments in which an extract of tuberculous guinea pig lymph nodes greatly reduced the num-

ber of carbol-fuchsin-staining tubercle bacilli in an emulsion, while an extract of normal nodes had no such effect. In this report he makes no mention of the effect on virulence, and we have not been able to find in the literature any expansion or confirmation of his work. Some such factor may operate in our experiments.

The fact that the bacilli die so quickly in excised tissues inclines one to believe that when tubercle bacilli survive and keep their virulence for a long time in supposedly healed lesions, they are not completely encapsulated, not entirely isolated from the host's metabolism, but rather held in a state of minimum activity, a sort of hibernation, in which there is still some biological exchange between them and the host's tissues. This view seems more consistent with the current theory that the existence of such lesions is accompanied by active immunity, or at least altered immunity, against a new infection. It also offers some encouragement to our hopes of finding some successful method of chemotherapy in tuberculosis. But this lies outside the limits of our present experiments.

This much we do know with approximate certainty: that tuberculous nodes upon removal from the original animal, and for a few days thereafter, always contain virulent bacilli capable of producing manifest lesions in a fresh host, usually in two to four weeks; but that after these nodes have been in normal salt solution in the incubator for a few days, the bacilli have completely lost all power to produce such lesions in a fresh host — at least, no tuberculous lesions appear in 8 to 12 weeks after the tissues are planted.

This calls for a continuation of the experiments, to find out whether it is a simple matter of the bacilli being alive or dead, or whether there are stages of attenuation between, say, the second and seventh days, in which we may have bacilli which do not produce the usual disease, but may be capable of producing retarded or otherwise modified lesions. The calcification observed after plants of 2-day and 4-day tissues supports this latter view. We shall have to inoculate another series with nodes 1, 2, 3 days old and so on, and keep these pigs alive for from six months to a year, in order to see if any of them develop anything suggesting an attenuated infection.

If this proves to be the case, it will be desirable to attempt some immunizing experiments with incubated nodes, on the analogy of Pasteur's antirabic vaccination with dry infected spinal cords, beginning with the very attenuated and working up to the virulent. In the absence of any practical method of immunization against tuberculosis, all such ideas are extremely seductive, but must be tested in a very deliberate and critical spirit.*

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DISCUSSION ON PAPER BY DR. WEBB, DR. GILBERT AND DR. RYDER

Dr. H. J. Corper, Denver: In order to gain an insight into the survival of tubercle bacilli in physiologic saline solution I should like to call your attention to observations made by Griffith a few years ago and repeated in our work. Suspended in saline they will live from three to six months on an average, while in distilled water they lose their viability in from one to two months. Dr. Webb's paper was of interest to me because it brought back memories of the days when I believed, as no doubt must of us did, that tubercle bacilli could resist almost anything. However, as our studies multiply we find that in spite of the waxy composition or capsule of this microbe its resistance is not what might be expected. A few years ago I injected virulent human tubercle bacilli intravenously into rabbits in large amounts and attempted to recover them by test tube and guinea-pig inoculation. I found that I would obtain successful inoculations on the average for from one to two weeks but not thereafter, even though small microscopic tubercles were visible in these lungs.

Dr. Webb's studies are even more striking and highly interesting. They especially interest me because a clue as to the method of this rapid destruction in the tissues should lead to many other interesting discoveries on the mode of destruction of the bacillus in the body.

Dr. William Charles White, Pittsburgh, Pa.: Dr. Corper has referred to the "wonderful waxy capsule." I have never been able to convince myself that there is a capsule of the tubercle bacillus, but that the whole body substance has an integral waxy substance in it. I would like to ask Dr. Corper if he thinks it is a waxy capsule or that the whole body substance is of one composite material.

Dr. Corper: I should not like to enter a controversy on the capsule of the tubercle bacillus but can refer Dr. White to an article, by an English writer, Miller, in which the bacillus has been likened to the pod of a pea, in which the pod is distinctly outlined. I personally incline to the belief, however, that the wax of the tubercle bacillus is incorporated as a chemical component part of the bacillus and not as a capsule, any more than our covering of skin should be called a capsule. Last year in discussing the simplicity of the tubercle bacillus with Dr. Vaughan and Dr. Lewis I

believe Dr. Vaughan was correct when he stated that "the tubercle bacillus, though minute, is nearly as complex chemically as man."

Major Nathan Barlow, New Haven, Conn.: Dr. Webb tells us that he can cause the death of the tubercle bacilli in glands inserted in a living animal without causing solution of the bodies of the bacilli, and without producing antigenic reactions, apparently on account of the altered condition of the glands. Now, our friends, the roentgenologists, tell us that by x-ray treatment and by some other forms of radiant treatment, they can cause the disappearance and eventual healing of tuberculous glands and produce no reactions during the treatment. We know that the x-ray has an especially destructive influence upon lymphoid cells, and I should like to ask Dr. Webb whether he thinks that there is any connection between the death of the bacilli in his experiments, and the death without reaction reported by the roentgenologists.

Dr. Paul A. Lewis, Philadelphia, Pa.: This discussion has certain practical significance for those who are expected to examine surgical material. Surgeons have a habit of sending glands, bone tissue, etc., to the laboratory quite at their convenience. I have for a long time felt that there was some doubt as to whether tissue which had been kept in the icebox for several days was satisfactory for securing inoculation for tuberculosis and subsequent cultures. Dr. Webb's paper would indicate that there should be very little delay between the removal of tissue and inoculation.

The other thing which Dr. Webb's paper illustrates to me is that not all the problems in tuberculosis are extraordinarily abstruse and require extraordinarily large equipment to conduct. In other words, for those of us who have not the utmost facilities the main thing to think of is the problem which is adapted to our circumstances. Such problems, either simple or complex, lie everywhere at hand.

Dr. Webb: I confess, in regard to the question of the capsule which was referred to, I cannot give you much light. But Dr. Theobald Smith, in this Association some seventeen years ago, called attention to the capsule apart from the coating of wax. He stated that it disappeared more or less when you cultivate your bacteria. I don't believe the points have ever been disproved.

In regard to the question of Dr. Barlow, we feel, of course, that in the human body, in the lymph node, that there the bacilli are not deprived of their oxygen, and that they are hibernated; and it was with that in view that our first experiments were conducted. It has also been my feeling that if we can imitate nature in any way we are going to succeed. Nature in her crude and destructive vaccination of the human race, kills some ten per cent., while to ninety per cent. she gives some relative immunity. We find in those bodies tubercle bacilli usually in lymph nodes still living, and in a condition, we might say, of hibernation, and from them we get a certain amount of immunity, and the idea originally in our experiments was to imitate that. I can't correlate the treatment by the x-ray in this matter because I don't see how they are to deprive these bacilli of oxygen.

I am much obliged for Dr. Lewis's remarks, which are important. I had not thought about the fact that these materials, when kept for some time and then sent for inoculation in guinea pigs would produce, one can easily see, a negative report, as shown by the result of our experiments.

THE GRIFFITH METHOD FOR DIRECT ISOLATION OF THE TUBERCLE BACILLUS

By Harold W. Lyall, Ph.D.

Pittsburgh

Uncertainty of successful results in the majority of methods proposed for direct isolation of tubercle bacilli from sputa and other fluids or excreta has led to a general feeling that the most reliable procedure is to resort to inoculation of animals, with subsequent isolation from the tissues at autopsy. Objections to this procedure are that possible changes in virulence or growth characteristics may occur in the organisms as a result of animal passage, and, also, the length of time required before final isolation in pure culture. In the usual direct methods the manipulations involved favor the chance of contaminations. A method which would be at the same time simple and uniformly successful would be welcome. That proposed by Petroff[1] constituted a step forward, but did not greatly reduce the manipulations necessary and, without the use of gentian violet medium, did not yield as high a percentage of non-contaminated tubes as could be desired.

In 1914 and again in 1916, Griffith,[2,3] in articles dealing with types of tubercle bacilli found in sputa, made brief note of a method which he was using for the direct cultivation of his strains. The simplicity and reliability of the method, and the fact that it did not seem to have become generally known, made it appear to warrant further investigation. As described by him, equal parts of sputum and 10 per cent. antiformin were mixed by shaking or stirring in a test tube, and a loopful of the mixture, after it has become partly fluidified, streaked directly onto suitable media. There was thus no sedimentation or washing, which is ordinarily thought necessary to overcome the inhibitory effect of the antiformin. Griffith obtained cultures in this way in 26 out of 31 specimens.

In the present investigation, essentially the same technique was used. Although previous work had shown that successful results could be obtained when the final concentration of antiformin was as low as 2.5 per cent., the greater number of contaminated tubes made it seem advisable to use the higher strength.

Sputum, preferably the early morning specimen, used for culturing was collected in a sterile petri dish, but no further precautions, such as washing the specimen, were taken. Equal parts of sputum and 10 per cent. antiformin by volume are mixed in a stoppered agglutination tube. About two cubic centimeters is a convenient amount. This is measured

by rough graduations on the tube rather than by accurate measurement with a pipette. The mixture is well shaken and cultures made at the end of five-minute intervals from five to thirty minutes.

The following media were used at different times during the work: (a) plain egg, original Dorset formula; (b) 1 and 5 per cent. glycerin egg; (c) liver egg — four parts egg to one of fresh calf liver infusion; (d) liver egg with 5 per cent. glycerin; (e) egg medium with 1 per cent. inulin, and (f) egg medium prepared according to Petroff's formula but without gentian violet. No dye was incorporated in any of the media, because it was desired primarily to test the reliability of the technique as judged by the number of uncontaminated pure cultures obtainable.

The liver infusion is prepared in essentially the same manner as ordinary beef infusion. Five hundred grams of finely chopped fresh liver (calf or beef) are soaked over night in the cold with 1000 cubic centimetre of tap water. The next morning the infusion is brought slowly to the boiling point and boiled for five minutes, then filtered through paper. The use of liver suggested itself from favorable experience of the author with the ordinary liver agar (Dopter) for the cultivation of meningococci and gonococci. At that time it was found that the usual stock strains of tubercle bacilli grew luxuriantly on such a medium. It was hoped that with a large series of cases cultured at the several intervals, some one interval could be shown to be the most favorable for routine, and thus still further simplify the method. Unfortunately this did not prove wholly true. The several media were used for comparison with the liver medium which constituted a slight modification of the various media at present generally used for the cultivation of the tubercle bacillus.

A total of fifty-six separate cases were cultured. The number of tubercle bacilli on stained smears of sputa used for cultures varied from those containing innumerable organisms to the microscopic field to sputa in which no acid-fast organisms could be found on the slide examined. The majority of specimens ranged from one to ten organisms to the field. Ten cases with only a Gaffky I count were cultured and there were two cases in which no organisms were found on microscopic examination. These negative specimens had, however, been positive at some time during the patient's stay at the hospital. As mentioned above, no special precautions were taken to obtain a perfectly clean specimen and many were not as good as could be desired, often containing much saliva and many secondary organisms.

Tubercle bacilli were isolated in pure culture from all but one of the cases. It was usual to have good uniform growth on tubes of some media at all intervals, without growth of secondary organisms. Over 90 per cent. of the specimens yielded pure cultures without contaminations in any of the tubes. Out of a total of 1080 tubes throughout the whole study, only fifty, or 4.5 per cent. showed any contaminations. As a rule such contaminations, when they did occur, consisted of one or two single colonies, and the tubercle colonies could easily be fished in pure culture. Contaminations were usually confined to tubes seeded at the five-minute

interval, and not always all of these tubes. In only five cases did secondary growths run beyond this point. In one case thirteen tubes out of twenty-five were contaminated, the next highest being seven out of twenty-five. It was rare to find over one or two contaminated tubes in the series, and almost never beyond the five-minute interval.

Usually, as stated above, good growth was obtained at all intervals on suitable media. Although generally true, this did not hold for all specimens examined, so that the hope that some single definite time interval could be selected as most suitable and applicable to all specimens was not fulfilled. Except for a small number of specimens, the ten-minute interval could be taken and yield pure cultures without contaminations. Some few, however, showed distinct variation, in that growth might occur at only one or more of the several intervals without appearing on the tubes seeded before or after. It was often true, where growth occurred throughout the series, that the most luxuriant growths were obtained on the twenty to thirty minute transplants. Undoubtedly, as Griffith suggested, several factors enter into such variations — such as the character of the original specimen and the readiness with which it digests, the possibility of some of the organisms which appear on the stained smear being dead, and undoubtedly an individual susceptibility of strains to the action of antiformin. One case in the present series, a strongly positive sputum, was cultured five times with only one positive result after the first trial in which growth occurred only on three out of five tubes at the five-minute interval. Again, in another case, growth was obtained in only three of the five-minute tubes, and these tubes showed, respectively, heavy seeding on the first, six colonies on the second, and three on the third tube, exactly in the order in which they were planted, an interval which was never more than thirty seconds. Only one example of the other extreme was noted. In this case growth appeared only on the tubes seeded after thirty minutes. This would appear to indicate that different strains show marked variation in their ability to withstand the action of antiformin.

The first appearance of growth (visible to the naked eye) varied from six days in the earliest up to thirty days in one case. Twenty-eight per cent. of the specimens showed growth in ten days or less, and seventy-three per cent. before the fifteenth. Here again this was not dependent upon the number of tubercle bacilli present in the stained sputum. Of the several kinds of media used the most uniformly successful from the several view-points, *i. e.*, earliness in initial appearance of growth, heaviness of seeding and final luxuriance of growth, was that containing liver infusion, either with or without glycerin. This medium was always far superior to the Dorset medium, and, in the majority of cases, surpassed all other media. A rather interesting point, I feel, was that almost invariably the liver egg (without glycerin) showed initial growth well before any of the other media, although eventually (as five weeks, when the final reading was made) media containing glycerin, in particular the glycerin liver egg, might show a great final luxuriance.

CONCLUSIONS

In fifty-five out of fifty-six specimens tubercle bacilli were isolated in pure culture by the Griffith direct method.

Less than five per cent. of a large number of tubes showed any contaminations.

The most uniformly successful medium for the direct isolation of tubercle bacilli from sputum was one containing beef liver infusion in the proportion of one part infusion to four parts of egg.

The simplicity and uniformly successful results with this method constitute a distinct advance over other methods at present in use for the direct isolation of tubercle bacilli from sputum.

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DISCUSSION ON PAPER BY DR. LYALL

Dr. Lawrason Brown, Saranac Lake: Mr. Daniel Smith and I did some work along this line some eleven years ago. We washed the sputum, and subjected it to antiformin, and planted it on ordinary blood serum tubes. We found that we got a very large number of growths, and we got growths from some specimens in which at that time we could find no tubercle bacilli at all.

Dr. Harold L. Amoss, New York: I would like to ask what kind of concentration the medium was adjusted to, and whether the growths were in the medium or simply on top.

Dr. Lyall: Answering Dr. Amoss, we made no particular attempt to adjust it to any definite concentration. We simply add one part to four parts of egg, which I presume reduces the acidity somewhat.

I don't just know what you mean by the other part of your question — solid medium?

Dr. Amoss: Yes.

Dr. Lyall: It was coagulated in a slanted position.

TUBERCULOSIS OF THE HEART — WITH THE REPORT OF TWO CASES*

By Edward Weiss, M.D.

Philadelphia, Pa.

In a study of 7219 necropsies Norris[1] found 1780 tuberculous and among these 82 cases of tuberculous pericarditis. In 5 cases the heart muscle was involved. This indicates the relative infrequency of the conditions being reported. A point of added interest is the unusual degree of involvement in the first case.

Case history: The patient, a colored male, aged 25, was admitted to the Jefferson Hospital, on the service of Dr. H. A. Hare, December 27, 1920, complaining of pain in the upper half of the abdomen and chest. His family history was negative for tuberculosis. He had gonorrhea in 1909 and syphilis in 1913 for which he received no treatment. In October, 1918, he had an attack of influenza and since then a persistent cough at night. In July, 1920, he developed abdominal pain which grew progressively worse and about December, 1920, his abdomen began to enlarge. His cough became more severe; he was dyspneic and complained of pain in his chest. He stated that he had lost 40 pounds in the past year.

On examination there were evidences of a pleural effusion at the right base and immense enlargement of the heart — both confirmed by x-ray. His abdomen was slightly distended and tender and the liver could be palpated at the level of the umbilicus in the right mid-clavicular line. There was some fluid in the left tunica vaginalis. Blood count showed a leukopenia and moderate secondary anemia; his blood Wassermann was positive; his sputum was negative for tubercle bacilli. He died February 21, 1921, and necropsy was performed the same day.

Necropsy report: The body was that of an adult colored male, weighing about 70 pounds. The heart and pericardium were immensely enlarged, weighing 1580 grams, the pericardial cavity being obliterated by large, dense, yellowish nodules which invaded the heart muscle, auricles and ventricles to a similar degree. The nodules were continuous with the mediastinal and peribronchial lymph nodes which were also large, yellowish and firm. No tuberculosis of the lungs could be established but the pleurae averaged about .4 cm. in thickness and this thickening was especially marked at the right base which contained an encapsulated effusion of about 700 cc. of brownish-red serum. The spleen,

* From the Department of Pathology, Jefferson Medical College.

right adrenal, kidneys and liver showed a number of firm, yellow nodules scattered throughout. At the juncture of the ileum and cecum was a large ulcer, 2.5. cm. in diameter, with base of reddish granulations and firm, undermined edges. This, with the large, firm and yellowish mesenteric and retroperitoneal nodes aided in the gross diagnosis of tuberculosis.

The microscopic study revealed a fibre-caseous tuberculosis of the following organs and tissues,— pericardium and myocardium, plurae, spleen, right adrenal, kidneys, liver, mediastinal, mesentric and retroperitoneal lymph nodes. No typical tubercles were seen and very few giant cells. Smears from the fresh material and stained sections of pericardium, pleura, and retroperitoneal nodes were studied for tubercle bacilli but failed to reveal the organism. Guinea-pig inoculation, however, produced a diffuse tuberculous lymphadenitis and tuberculosis of the spleen. Smears from the caseous nodes showed many tubercle bacilli but attempts to culture the organism failed.

I am indebted to Dr. E. H. Funk for the clinical notes of the second case.

S. W., a colored male, aged 25, diswasher by occupation, was admitted to the Department for Diseases of the Chest of the Jefferson Hospital on March 15, 1921. He complained of a dull pain in the back and sternal region and of a moderate cough productive of a large amount of mucoid sputum which was occasionally blood-streaked.

His family history was negative for tuberculosis. He had a chancre in 1913 and gonorrhea in 1914. He stated that he had been in poor health ever since his discharge from the Army in 1918. At that time he noticed a cough. Shortly after the onset he became short of breath on slight exertion and felt weak. From time to time he had a vague pain in the front of the chest. Increasing disability caused him to give up his work in the latter part of January, 1921. He entered a Philadelphia hospital and was later transferred to the Jefferson Chest Hospital.

Physical examination showed an emaciated, colored, adult male. His pupils reacted normally. Throat was red, tonsils swollen. The cervical lymph nodes were distinctly palpable with a small mass of enlarged glands above the clavicle on the left side. Chest was long, narrow and flat. Expansion was generally limited. Vocal fremitus was increased throughout the right side of the chest and the percussion note was generally impaired. Breath sounds were distinctly audible with a blowing characteristic over the entire chest except the right base posteriorly where the intensity was diminished. Many squeaking sounds were heard with numerous crackling rales throughout, especially on the right side. Whispering pectoriloquy was noted in the third interspace on the right side, anteriorly.

Heart: There was marked precordial pulsation with an increase to the left in the lateral diameter of cardiac dulness. Heart action was rapid but regular; heart sounds were distinctly heard; no murmurs were present. Sputum examinations were repeatedly negative for tubercle bacilli. Urine contained a trace of albumin and an occasional hyaline cast.

Temperature 102°; pulse 130; respirations 40. Patient died April 25, 1921, and was necropsied the following day.

Necropsy Report — The important findings were as follows: The anterior cervical lymph nodes were distinctly palpable and those on the left side just above the clavicle were especially enlarged. There were several enlarged, firm yellowish nodes adherent to the posterior surface of the sternum. All of the mediastinal nodes were similarly enlarged, clustered about and pressing upon the trachea and larger bronchi. These nodes varied in size from less than 1 cm. to 3 or 4 cm. in diameter. Some had caseous centers.

The pericardial cavity was distended with about 700 cc. of blood-tinged serous fluid. There was likewise a dense, yellowish, fibrinous exudate present. The visceral pericardium of the left ventricle was distinctly thickened, measuring about .3 cm., and consisted of a zone of dense, yellowish tissue made up of conglomerate nodules which grew larger near the base of the ventricle at the reflection of the pericardium. These nodules, unlike those of the first case, showed no tendency to invade the heart muscle. The lymph nodes at the base of the heart were of the same type as the mediastinal nodes and were continuous with them, pressing upon the great vessels. These nodes were likewise firmly adherent to the pericardium.

The Left Lung: The left pleural cavity contained about 500 cc. of blood-tinged serous fluid and the lung was compressed. On section the pulmonary tissue was dark red in color and only partially crepitant. About 6 cm. from the apex, on the antero-lateral surface of the lung, was a conglomerate caseous tubercle, a little less than a cm. in diameter. There was no further evidence of tuberculosis in the lung structure: the nodes at the hilus, however, were greatly enlarged, similar to and continuous with the mediastinal nodes.

The Right Lung: It was more voluminous than the left but on section presented nearly the same appearance. Near the hilus, a little area of pulmonary tissue, about 2 cm. on diameter, adjacent to an enlarged and caseous lymph node, showed tuberculous infiltration.

None of the other organs showed any evidence of tuberculosis but the mesenteric and retroperitoneal lymph nodes were moderately enlarged, firm and yellowish.

A few tubercle bacilli were found in smears from the caseous mediastinal nodes.

Microscopic study revealed a typical caseous tuberculosis of the structures mentioned. The pericardium showed the lesion especially well; unlike the first case, there were many typical tubercles present with caseous centers and numerous giant cells. The tuberculous process, as mentioned in the gross description, exhibited no tendency to invade the myocardium.

Guinea-pigs were inoculated with emulsified caseous nodules from the base of the heart. The animals, killed six weeks later, showed tuberculosis of the abdominal lymph nodes and spleen. A number of tubercle

bacilli were recovered in smears but cultures both on Petroff's and Dorset's media failed to develop the organism.

COMMENT

In 1902 Anders[2] summarized 71 cases of tuberculosis of the myocardium and added a case of his own. He classified the condition as occurring in three forms: (1) large tubercles; (2) miliary tubercles (less common), and (3) diffuse form or tuberculous infiltration (rare). He stated that cardiac tuberculosis was most frequent in early life, 40 per cent. of his cases occurring under 15 years. In a large proportion of cases, the lungs and bronchial glands were tuberculous. In 29 out of 31 cases in which the glandular condition was noted, tuberculosis was present and this he believed to be the seat of the disease. This extended from the bronchial to the mediastinal nodes and thence directly to the heart or quite commonly by way of the pericardium.

Cases very similar to the present ones have been reported by Ellis,[3] Raviart and Caudron,[4] Benda and Geissler,[5] Toldt,[6] Passamonti,[7] Beifeld,[8] Fraga,[9] and more recently by Adamson,[10] Doermer,[11] and Binder[12].

Ellis' case presented, in addition to tuberculous pericarditis and myocarditis, tuberculosis of the mediastinal nodes and lungs and a miliary tuberculosis of liver, spleen, pancreas and kidneys. Only after a study of many blocks from the heart were a few tubercle bacilli seen in one section. Beifeld's case showed a tuberculous scar at the apex of the left lung and a caseous tuberculosis of the mediastinal, tracheal, bronchial and left lower cervical nodes. There was a tuberculous pericarditis with total obliteration of the pericardial sac. The liver and spleen contained conglomerate tubercles. Microscopic examination demonstrated typical tuberculous tissue but up to the time of his report search for tubercle bacilli in the tissues was unsuccessful. He concluded that infection traveled from the left apex to the mediastinal nodes and then by contiguity or lymphatic extension or both, to the pericardium and by contact infection to the heart muscle. In Adamson's case no evidence of tuberculosis was found in the lungs or bronchial lmph nodes but he felt that the process probably started in the nodes at the base of the heart.

It is generally conceded that the mediastinal nodes act as the focus of infection for the pericardium and myocardium in this condition. Toldt, however, reports a case of tuberculosis of the heart (limited to the right auricle) with no sign of pericardial involvement. He found but little evidence of tuberculosis disease in the tracheo-bronchial nodes but did note a healed lesion at the apices of both lungs. In commenting upon the conditions he mentions that Fuchs in a report of fifty-three cases of tuberculosis of the myocardium, found twelve cases of isolated auricular tuberculosis. Of these the right auricle alone was affected in nine; both auricles in two; and the left auricle only in one. Of the twelve cases eight showed tuberculous pericarditis, in two the pericardium was unaffected and in two the condition was not stated.

Passamonti also reports a case of tuberculosis of the myocardium with no other tuberculous lesion except a nodule in the lower lobe of the left lung. He did not feel that the usual propagation of infection (glandular) had occurred in his case. In a discussion of the condition he mentions that the finding is practically always a post-mortem one, and from a study of the literature brings out the fact that there are no characteristic signs of tuberculosis of the heart. He states that attacks of dyspnea, cyanosis, arythmia and enlargement of the cardiac area have been observed but adds that hypertrophy and dilatation are not always noted. Raviart and Caudron record a case in a white male, aged 31, with vague symptoms of oppression and pain in the epigastrium, and no definite physical signs. Necropsy revealed a tracheo-bronchial glandular tuberculosis and tuberculosis of the heart (confined to the right auricle). Toldt's case, mentioned above, occurred in a woman of 58 who had been ill for eighteen months, but, with "no symptoms of localizations." Examination showed deviation of the apex of the heart, arythmia and muffled apical murmurs—no other physical signs.

Anders made note of the following symptoms: palpitation, feeble heart sounds, pericardial distress, diffuse pulsation, tumultuous and rapid heart action, fetal and gallop rhythm, rarely murmurs, sudden and recurring syncope, dyspnea, cyanosis, unconsciousness, general edema and sudden death. But he states, "in all this list there is nothing specific, no single symptom or combination of symptoms that is not seen in functional and organic disease of the heart other than tuberculosis. Often the patient dies without a symptom that would attract special attention to the heart." Eisenmeyer is quoted by Anders as stating that a diagnosis may occasionally be made by the presence in a victim of general tuberculosis of sudden, severe collapse, quickly passing; and the detection of weak endocardial murmurs varying in phase and intensity.

One point not mentioned in the cases cited, is the apparently relatively frequent occurrence of this unusual form of tuberculosis in the colored race. Four cases: Ellis', Beifeld's and the two making up the present report, occurred in young, adult, colored males. For this reason it seems reasonable to suggest that when evidence of cervical and mediastinal glandular disease exists in a young, colored man with indefinite symptoms referable to the circulatory system and possibly signs of cardiac enlargement, tuberculosis of the heart should certainly be thought of. In this connection Beifeld's case merits particular mention. A colored male, aged 21, had dyspnea and cyanosis; cough, rapid, regular pulse of good quality; and an evening rise of temperature. Examination showed a heart enlarged to right and left. No murmurs were present but a systolic retraction was noted, in place of the apex beat. A clinical diagnosis was made of adherent pericardium, tuberculous in nature; the necropsy, as above described, confirmed this diagnosis.

SUMMARY

The brief clinical reports and necropsy findings of two colored, young, adult males are recorded. Symptoms and physical signs were vague; necropsy demonstrated an immense, fibro-caseous tuberculous involvement of the lymph nodes of the thorax, with extension to the pericardium and in the one case to the heart muscle, causing tremendous enlargement of the organ. Reference to the literature indicates that the heart involvement is almost always secondary to the disease of the mediastinal lymph nodes. The practical limitation of the process to the lymph nodes, the curious reaction of the tissues and the difficulties in the diagnosis of such conditions are some of the problems offered to pathologist and clinician by these case reports.

I am indebted to Dr. H. A. Hare and to Dr. Thomas McCrae for permission to report these cases.

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DISCUSSION ON PAPER BY DR. WEISS

Dr. Alfred Meyer, New York: May I ask whether the pericardial fluid was aspirated, and whether an examination was made? It might have cleared up the diagnosis in the second case. I was wondering whether the physical diagnostic conclusion of enlarged heart in the second case was not an error of diagnosis, and that the apparent enlargement of the heart was due to pericardial effusion.

Dr. Weiss: I had hoped that Dr. Funk would be here to discuss the

*Not available for study.

clinical findings of this case. I can say, however, from what he has told me, that the pericardial effusion was not diagnosed. The area of cardiac dullness was increased and attributed to cardiac enlargement. The effusion, I felt and he felt, was largely an agonal affair. In it we found the pneumococcus. We did not recover the tubercle bacillus from the fluid.

THE COURSE OF PULMONARY TUBERCULOSIS IN GUINEA-PIGS, PRODUCED BY THE INHALATION OF A LOW-VIRULENT STRAIN*

By LeRoy U. Gardner, M.D.

Saranac Lake, N. Y.

(Abstract)

The outcome of the pulmonary tuberculosis to be illustrated in these lantern slides is one which has been generally overlooked by pathologists. Most of our text-books describe the end results of healed tuberculosis as either fibrosis or calcification. A few authors casually mention that tubercles may be absorbed but usually such mention seems to be categorical and is apparently not based upon actual observation.

The slides illustrate the course of experimental tuberculosis produced in the guinea-pig's lung by the inhalation of a moist spray of a low-virulent culture strain of tubercle bacilli. This strain was isolated by Dr. Trudeau from a human case of meningitis and has been maintained on artificial media for thirty years. It is known at the Saranac Laboratory as "R_1". When inoculated subcutaneously into the groin of a guinea-pig it produces macroscopic lesions in the lymphoid tissue only. These lesions are self-limited, tend to heal, and the animals inoculated with it may in a sense be considered analogous to those human cases of tuberculosis which are able to localize their infection in lymphoid tissue without clinical evidence of disease.

The lantern slides will make it plain that a moist spray containing relatively small numbers of these organisms is capable of producing typical tubercles within the guinea-pig's lung. These tubercles, appearing first beneath the pleura, undergo the usual development and within three weeks usually show typical caseation. As in all tubercles, the collateral inflammatory reaction about the periphery of the tubercle is more or less analogous to granulation tissue, with a dilatation of already existing vessels and a rapid proliferation of young connective tissue cells. In the course of a varying period of time (two to ten months) this granulation tissue at the periphery of the tubercle becomes more dense and contracts. At the same time the caseous matter becomes granular, is invaded by phagocytes and is finally completely removed. The contraction of the connective tissue elements results in a localized area of emphysaema about the focus of disease.

* Lantern slides were shown in connection with this paper. A complete discussion of the subject with accompanying illustrations will appear in The American Review of Tuberculosis.

the normal alveoli are distorted and pulled in to occupy the formerly diseased area. With the complete absorption of the caseous center and the shrinking of the scar tissue the focus is represented by an area of enlarged irregular alveoli with somewhat thickened walls. In time even these traces disappear and, due to a gradual readjustment of space relationships, the alveoli now appear entirely normal.

The pleura usually shares in the reaction to the inhaled bacilli in the formation of a localized cap of granulation tissue above the tubercle. This is often of considerable thickness and is not so readily absorbed as the intrapulmonary reactive elements. In consequence one frequently encounters foci of pleural thickening in lungs with no trace of tubercle; or such a thickening may call attention to slight distortions of underlying alveoli which occupy the site of a former tubercle.

There is another non-specific reaction occurring in the lungs of these animals, *i. e.*, large peripheral masses of lmphoid tissue. Whenever any foreign body enters the alveoli it must be removed by the lymphatic circulation. Under the stimulation of considerable quantities of such foreign material, whether it be tubercle bacilli or dust, the small peripheral collections of lymphoid cells undergo hyperplasia and a large collection of such cells is the result. These collections persist long after other traces of the infection have disappeared. Together with the focal pleural thickening such hyperplastic lymphoid masses are frequently the only index of previous infection.

The lymph nodes at the bifurcation of the trachea become involved secondarily to the pulmonary lesions, usually at about the third week. Due to the concentration of large numbers of bacilli at this small focus, the lesion is generally more severe here than in the lungs, and, in consequence, it persists longer but ultimately it may likewise become absorbed.

DISCUSSION ON PAPER BY DR. GARDNER

Dr. Paul A. Lewis, Philadelphia: It seems worthy of comment, as Dr. Gardner has said, that this type of resolution should be really demonstrated. One has frequently seen in guinea-pigs or rabbits particularly, evidence that a lesion could heal by resolution, but for the most part these are the early lesions, the more or less submiliary type of tubercles. I think that this is the first suggestion of real evidence that a lesion which had gone so far as to caseate, underwent a rather complete and perfect resolution.

The Chairman: I would like to ask Dr. Gardner what happens with reference to the hypersensitive reactions, the end of the process?

Dr. Gardner: As regards the sensitivity of the skin, we find that the animal is sensitive up to nine months, or a year possibly, after the infection. Of course, we have lesions persisting in the tracheo-bronchial gland for a variable length of time after infection, and until these lesions likewise become absolutely burned out, the skin sensitivity will persist.

Of course, the duration of the tracheo-bronchial gland lesion varies with the amount of pulmonary involvement.

The Chairman: At the end, after the healing of the lesions in the lung, are the lesions in the gland still active?

Dr. Gardner: The gland lesions are still active.

STUDIES OF THE INFLUENCE OF CARBON DIOXIDE ON THE RESISTANCE TO TUBERCULOSIS: THE EFFECT OF CARBON DIOXIDE UPON THE TUBERCLE BACILLUS*

By H. J. Corper, M.D., H. Gauss, M.D., and O. B. Rensch, M.D.

Denver

The resistance to tuberculosis which is evident at almost every post-mortem performed on man has been variously explained as the result of the humoral antibody action in the Ehrlich sense of the term, the entire gamut of antibodies having at some time or other come into pre-eminence, or a specific cellular reaction or response in the phagocytic sense, as used by Metschnikoff; the lymphocyte, the polymorphonuclear leucocyte, the connective tissue cell, the endothelial cell and other less prominent cells at times occupying the foreground. That some of these factors no doubt play a significant part cannot be denied but the analysis of the individual factor from the standpoint of the exact rôle, prominent or insignificant, leaves much to be desired in the way of explanation.

The excellent recent researches of Nathan C. Foot,[1] Permar,[2] and Karsner and Swanbeck[3] on the vascular endothelial cell leave very little doubt but that this cell plays a definite part in the cellular combat against the tubercle bacillus; the exact proportionate relation of this cell to resistance to tuberculosis, however, still remains to be disclosed. That the allergic reaction is in some way associated with resistance to tuberculosis as was indicated in Koch's pioneer observations[4] seems to be borne out by the researches of Trudeau,[5] Krause,[6] Soper,[7] Römer and Joseph[8] and others.

That there might be a purely chemical factor active in the determination of the individual resistance to tuberculosis seems to have been lost sight of primarily because of the lack of any experimental evidence indicating this possibility. Upon entirely empiric clinical reasoning Weber[9] believed he saw a relation between carbon dioxide and resistance to tuberculosis, but his sublime contempt for laboratory findings expressed in the following paragraphs taken from one of his articles removed from him the opportunity of proving or disproving his contentions and even justifying his voluminous monographs extending over a period of seventeen years on this subject.

* This paper, with illustrations, appears in The American Review of Tuberculosis for September, 1921.

"Wir kennen die Einwirkung der Kohlensäure auf die Tuberkelbacillen nicht, versprechen uns von dieser Kenntniss auch keine grossen Vortheile für die Fragen, die sich auf die therapie der Phthise beziehen, denn dass Gedeihen oder Nichtgedeihen dieser kleinen Schmarotzer in der Nahregelatine kann doch nicht ernstlich mit ihrem Wuchern im menschlichen Körper verglichen werden."

Weber reasoned that the tubercle bacillus invades the body of almost all of mankind yet only about thirty per cent. of all deaths are due to this disease; individuals who eat insufficiently are disposed to tuberculosis (Brehmer) and treatment benefits only in so far as it stimulates the appetite; carcinoma affects the strong, tuberculosis the weak; diabetics are highly susceptible to tuberculosis because there is a diminished carbon dioxide production as a result of the lack of power to combust or utilize sugar; phthisis becomes arrested or ameliorated during pregnancy in spite of the fact that the reverse might be expected, explicable on the basis of the increased carbon dioxide contributed to the mother by the fetus—this is changed after delivery when tuberculosis again develops with renewed vigor; in cardiac conditions leading to venous stasis and accumulation of carbon dioxide there is a high so-called "immunity" to tuberculosis, while children with pulmonary stenosis die early of this disease; the accumulation of carbon dioxide in the lungs in emphysema is the source of the high relative immunity of these cases to tuberculosis; "hunchbacks" with their condensed thoraces are spared from tuberculosis because the lungs have not developed in relative proportion to the other organs and are called upon to dispose of a greater amount of carbon dioxide; primary tuberculosis of muscle is rare because of its high content of carbon dioxide; further the apex of the lung is more readily involved by tuberculosis because it has less carbon dioxide than the other parts; and finally the rest treatment of tuberculosis is beneficial because the horizontal position causes a retention of more venous blood rich in carbon dioxide at the apex of the lung than in the erect posture, thus imitating the Bier stasis treatment.

It seems that Weber's policy after formulating an opinion was to develop an empiric treatment for tuberculosis based upon his conception in the hope that it would succeed regardless of basic scientific facts. Thus he began treating pulmonary tuberculosis in 1889 by giving sodium bicarbonate followed by hydrochloric acid by mouth one-half hour before meals in order to generate carbon dioxide in the stomach as a means of increasing the carbon dioxide content of the blood and tissues. Later in 1901, realizing the impossibility of administering sufficient sodium bicarbonate and hydrochloric acid to produce an appreciable increase in carbon dioxide in the body he sought other means to accomplish his end. Reasoning that a man of 150 pounds exhales about 500 liters of carbon dioxide daily and by comparison a fetus of about 3 pounds should produce about 10 liters, the addition of the latter amount, therefore, should be necessary to arrest the disease if conclusions can be drawn from the arrest of tuberculosis in pregnancy. The production of this amount would require at least 40 grams of sodium bicarbonate and could not be

given by stomach feasibly. Therefore a substance combustible to carbon dioxide in the body would be a desirable adjuvant. He used for this purpose levulose feedings in amount of 50 to 100 grams daily continued over a period of months and further gave subcutaneous injections of olive oil and vaseline or paraffine oil in the belief that the latter produced carbon dioxide in the body. Had Weber manifested even a slight interest in laboratory investigation instead of boasting of his contempt for it he might have learned that paraffine oil cannot produce carbon dioxide in the metabolism of the body.

In 1902 he finally outlined his complete treatment. To the less severe cases of tuberculosis he gave sodium bicarbonate and hydrochloric acid by mouth with feedings of levulose to reinforce the carbon dioxide production, and in the more severe cases he combines the foregoing with the subcutaneous injections of liquid paraffine in 10-gram amounts twice daily, reaching in some cases as high as 200 injections.

That carbon dioxide may have an influence upon the growth of the tubercle bacillus was indicated by the studies of Wherry and Ervin in 1918.[10] They were studying the effect of gaseous environments upon the growth of bacteria and found that the complete removal of carbon dioxide prevented the growth of the tubercle bacilli even in the presence of all the other gaseous constituents of the air. The bacilli remained in a non-productive state but viable, as shown by guinea-pig inoculation two weeks later. They found also that when oxygen and carbon dioxide reach an optimal point, growth starts. Under atmospheric carbon dioxide (7 mm.) pressure, there was growth but at higher pressures (77 mm.) there was no growth of the tubercle bacillus. They called attention to the fact that in a closed system not only does carbon dioxide accumulate but the oxygen supply diminishes. Their experiments, although significant in indicating that carbon dioxide would inhibit the growth of tubercle bacilli, were not elaborate enough to give any idea as to the approximate concentrations or conditions under which this occurred. Experiments recently performed with the gonococcus by Rockwell and McKann[11] indicate that bacteria manifest evidence of respiration before evidence of their growth appears and growth is not visible until considerable changes in the gaseous environment (in sealed tubes) have occurred. The gaseous constituents changed from carbon dioxide 0.5 per cent., oxygen 19 per cent. to carbon dioxide 6 per cent., oxygen 2.5 per cent.; in pure hydrogen 3 per cent. carbon dioxide concentration was attained. Moisture plays some rôle, but is of far less importance than the gases.

The carbon dioxide tension of the tissues may be approximated from the studies made by Haggard and Henderson[12] who investigated the gas tensions of the abdominal cavity, alveolar air, and blood in animals. They state that the carbon dioxide tension of the abdominal air (normally approximating a tension of 35 to 42 millimetres mercury) soon becomes equivalent to that of the pulmonary alveolar air and of the arterial blood, and that under abnormal conditions (experimental acidosis) the carbon

dioxide tension in the abdominal air falls in close correspondence to the arterial carbon dioxide tension (as low as tension 61 to 23 millimetres mercury). In man gaseous studies have been made in cases of tuberculosis with pneumothorax to gain information on the proper gas mixture to be used in the artificial pneumothorax treatment of pulmonary tuberculosis. Fortunately the data is often repeated and well worked up so that its accuracy is undoubted. Webb, Gilbert, James and Havens[13] as a result of a study of a large number of cases found that after a short interval of time, regardless of whether nitrogen, oxygen or atmospheric air was injected into the pleural cavity, the composition of the gas rapidly approaches that of alveolar air. The carbon dioxide content of the pleural gases varied from about 5 to about 10 per cent. Tobiesen[14] found that an exudative pleuritis caused an increased carbon dioxide (to about 10 per cent.) content of the pleural gases as compared to a non-exudative type (about 6 per cent.). The carbon dioxide content of the pleural gases increases postmortem in man. Tachau and Thilenius,[15] using the more exact methods of gas analysis described by them, corroborated the above findings. In pneumothorax cases without an exudate the carbon dioxide content of the pleural gases ranged from about 6.5 per cent. to 8.5 per cent. and the oxygen content varied from 1.9 to 6.2 per cent., while cases with an exudate contained from 10.5 to 12.7 per cent. carbon dioxide and an oxygen content of less than 1 per cent.

It is known that certain chemical substances easily enter the cells and tissues while others are only found in the surrounding fluids of the body. The high potassium content of the cell as compared to the high sodium content of the fluids of the body is a classical example of this. Fortunately the recent observations of Jacobs,[16] who found that carbon dioxide is incomparably more toxic to toad tadpoles than are solutions of hydrochloric, oxalic, salicylic, formic, acetic or butyric acids of the same hydrogen ion concentration and in the presence of sufficient bicarbonate to give practically a neutral reaction to the solution, the toxic properties of CO_2 to tadpoles are unchanged, helps elucidate this mechanism of action. Jacobs interpreted these results as being due to the fact that the H_2CO_3, whose dissociation is held in check by the bicarbonate, can freely enter cells (perhaps as CO_2), while the bicarbonate cannot, the carbonic acid dissociating when within the cells to the extent permitted by the new conditions of equilibrium prevailing there, which may easily result in a hydrogen ion concentration higher than that of the surrounding medium. This conception is fortified by his observations with the flowers of Symphytum peregrinum containing a natural indicator sensitive to carbonic acid and an "artificial cell" prepared by him for illustration, wherein he produces a condition of intracellular acidity, being produced by a slightly alkaline solution of CO_2 in M/2 $NaHCO_3$ almost as effectively as by a solution of CO_2 in distilled water, though the hydrogen ion concentration of the latter solution is approximately four thousand times as great as that of the former. He believes that the ability of neutral and slightly alkaline solutions containing CO_2 to produce intracellular acidity is prob-

ably due to at least two factors, the weakness of H_2CO_3 as an acid and the lipoid solubility of CO_2 or H_2CO_3 or both, and the lack of such solubility in the case of bicarbonate.

The investigations on the effect of carbon dioxide upon the tubercle bacillus reported in this communication were initiated as a part of a study of the effect of various gases and pressures upon the growth of the tubercle bacillus. The results with carbon dioxide proved so interesting and valuable, however, that the studies were elaborated upon and extended to the animal. The greatest difficulty encountered in these studies was to develop a method suitable for the determination of carbon dioxide in small amounts of gas, not too accurate to be impractical and still of sufficient accuracy to be well adapted for the determinations at hand. The usual methods of analysis for carbon dioxide require comparatively large volumes of the gas to be analyzed and rather bulky and burdensome apparatus. The Hempel apparatus used by Tachau and Thilenius requires about 20 or more cubic centimeters and the Haldane apparatus used by Webb et al. about 30 or more cubic centimeters for each analysis. These systems of gas analysis contemplate the analysis of carbon dioxide by removing it by absorption, then measuring the decrease in volume of the original gas and then calculating the percentage volume or partial pressure of the carbon dioxide. Direct gravimetric methods have not been placed on an easily working basis presumably for two reasons: first, the great possibility of error from air contamination and consequent alteration which requires that the analyses be performed in a closed system, and second, the difficulty of measuring small amounts of carbon dioxide by any gravimetric system including the use of the ordinary analytical balance. Tashiro[17] has perfected the biometer by means of which he is able to measure carbon dioxide in almost incredibly small amounts (1.0×10^{-7} gram). The principle of this method is to note the precipitation of barium carbonate on the surface of a drop of barium hydroxide, in a suitably closed vessel (the biometer) filled with a carbon dioxide free gas, by the use of a lens. It was soon recognized that the needs in the work to be reported lay between the above two extremes and was not adaptable to either. It was necessary to analyze gases containing from one to ten per cent. carbon dioxide in an available few cubic centimeters of gas mixture sample.

In preliminary experiments it soon became evident that the barium carbonate precipitate from a barium hydroxide solution possessed possibilities for a system of analysis provided these small amounts could be utilized for a quantitative method. An attempt to determine the turbidity occasioned by the precipitated carbonate nephelometrically revealed a multiplicity of difficulties, some of which could not be overcome at present. The greatest difficulty was met when two suspensions of equal amount of carbonate were prepared and were found to reflect light at different rates and thus give entirely different quantitative values for the same amount of CO_2. It was, therefore, finally decided to measure the precipitated barium carbonate volumetrically.

METHOD

In order to prepare suitable standards of known carbon dioxide content both in gaseous or liquid form it was essential to use reagents of definite strength capable of delivering known volumes of carbon dioxide in gaseous form or containing a known amount of carbon dioxide in water soluble carbonate form. For this purpose a solution of sodium carbonate (or bicarbonate) was used and the calculations were made as follows:

Molecular weight of $Na_2CO_3 = 106$.
Molecular weight of $CO_2 = 44$.
$106 : 44 :: 1 : x$

$x = 0.41509$ gram CO_2 is obtained from 1 gram anhydrous Na_2CO_3 at 0°, 760 mm. B. P.

The weight of one cubic centimeter of carbon dioxide at 0° 760 mm. B. P. as given by Fresenius[18] is 0.001965 gram, therefore

$$\frac{0.41509}{0.001965} = 211.241 \text{ cc. } CO_2 \text{ is obtained from 1 gram anhydrous } Na_2CO_3 \text{ at 0°, 760 mm. B. P.}$$

The amount of sodium carbonate required to produce 1 cubic centimeter of carbon dioxide is

$$\frac{1.000}{211.241} = 0.00473 \text{ grams } Na_2CO_3 \text{ is necessary to produce 1 cc. } CO_2 \text{ at 0° 760 mm. B. P.}$$

These figures have to be corrected to values for the temperature, barometric pressure and vapor tension in which the experiments are being performed. The average barometer pressure of our laboratory is 630 mm., the average temperature is 20°, Dennis[19] gives the following formula for the correction of volumes of gases:

$$v_0 = \frac{v_1 \; p_1 - m}{760 \; (1 + 0.00367 \; t_1)}$$

in which v_1 is the observed volume, p_1 the observed pressure, t_1 the observed temperature and m the tension of aqueous vapor. Our problem, however, is to compute v_1 at the desired t_1 and p_1 from the known v_0, t_0 and 760; so adapting the formula, it becomes

$$v_1 = \frac{v_0 \; 760 \; (1 + 0.00367 \; t_1)}{p_1 - m}$$

When the volume of a gas changes it is evident that the weight of the gas is inversely proportional to the volume change. That is, if 1 cc. (V_1) becomes 2 cc. (V_2) and t and m remain constant, than 1 cc. of V_2 weighs only one-half of one cc. of V_1 which may be expressed as follows:

$$V_0 : V_1 :: W_1 : W_0, \text{ or}$$

$$W_1 = \frac{W_0 \; V_0}{V_1}$$

The volume of V_1 has just been adapted from Dennis, therefore to obtain the weight of V_1 we combine the two formulae and obtain

$$W_1 = \frac{W_0 \; V_0}{V_0 \; 760 \; (1 + 0.00367 \; t_1)} \cdot \frac{}{\frac{}{p_1 - m}}$$

from which we may compute the weight of 1 cc. of gas for any desired pressure and temperature if we know the weight at 0°, 760 mm. B. P. To compute the weight of 1 cc. of CO_2 at 630 mm. and 20° C. we substitute the known values for W_0 which is 1.96507 mg. $V_0 = 1$, $t = 20$, $p = 630$, $m = 17.396$ and obtain:

$$W_1 = \frac{1.96507 \times 1}{1 \times 760 \times 1 + (0.00367 \times 20)} \cdot \frac{}{\frac{}{630 - 17.396}}$$

$W_1 = 1.4973$ mg. = wt. of 1 cc. CO_2 at 20°, 630 mm. B. P.

To determine the number of cc. of CO_2 at 20° 630 mm. B. P. available from

1 gram $Na_2 CO_3$.

0.0014973 gm. = wt. of 1 cc. CO_0 at 20°, 630 mm.

0.41509 gm. CO_2 is obtained from 1 gram $Na_2 CO_3$ at 0° 760°.

Therefore,

$$\frac{0.41509}{0.0014973} = 277.225 \text{ cc. } CO_2 \text{ is obtained from 1 gram } Na_2 CO_3 \text{ at 20° 630 mm. B. P.}$$

To determine the amount by weight of anhydrous $Na_2 CO_3$ required to produce 1 cc. CO_2 at 20° 630, we consider that 1 gram $Na_2 CO_3$ at 630 mm. 20° forms 277.225 cc. CO_2 therefore,

$$\frac{1.000}{277.225} = 0.003607 \text{ gram } Na_2 CO_3 \text{ is necessary to produce 1 cc. } CO_2 \text{ at 20°, 630 mm. B. P.}$$

This last figure 0.003607 gm. $Na_2 CO_3$ or 3.61 mg. is the solution equivalent of 1 cc. of CO_2. A stock standard solution is then prepared by dissolving 361 milligrams of anhydrous sodium cabonate c. p. in 100 cc. distilled water. If one cc. of the stock solution is then diluted to 100 cc. one cc. is equivalent in carbon dioxide to 1 cc. of a 1 per cent. CO_2 air mixture. If two cc. of the stock solution are used, then 1 cc. becomes equivalent to one cc. of a 2 per cent. CO_2 gas mixture, etc.

It was observed that the precipitate of barium carbonate produced by

the equivalent of 1 cc. of a 1 per cent. CO_2 gas mixture could be collected and measured with reasonable accuracy in a Hopkins centrifuge tube[20] and occupied one five hundredth of a cubic centimeter. The technique used is as follows: Clean the Hopkins centrifuge tube thoroughly, add 1 cc. of the desired solution with a volumetric pipette, add 5 cc. of clear saturated barium hydroxide solution, kept under pure paraffine oil to avoid air and CO_2 contact. Quickly superimpose 1 cc. of CO_2 free paraffine oil and centrifuge five minutes at about 2000 r.p.m. It is frequently necessary to stir the sediment up gently with a fine wire and centrifuge a second time to insure a uniform and even packing of the precipitate. In this way it was found that 1 cc. solution equivalent to 1 cc. of a 1 per cent. CO_2 gas mixture gave a precipitate of barium carbonate occupying 0.002 cc. One cc. solution equivalent to 1 cc. of a 2 per cent. CO_2 gas mixture a precipitate occupying 0.004 cc., etc., as recorded in the following table 1.

TABLE 1

Volumetric determinations of the precipitate of barium carbonate corresponding to gas volumes obtained from the solution equivalent of carbon dioxide

STOCK Na_2CO_3 SOLUTION: (3.61 MGM. PER CC.)	DILUTED TO	EQUIVALENT TO GAS MIXTURE	VOLUME OF Ba_2CO_3 PRECIPITATE
cc.	*cc.*		*cc.*
1	100	1 cc. 1% CO_2	0.002
2	100	1 cc. 2% CO_2	0.004
3	100	1 cc. 3% CO_2	0.006
4	100	1 cc. 4% CO_2	0.008
5	100	1 cc. 5% CO_2	0.010
6	100	1 cc. 6% CO_2	0.012
7	100	1 cc. 7% CO_2	0.014
8	100	1 cc. 8% CO_2	0.016
9	100	1 cc. 9% CO_2	0.018
10	100	1 cc. 10% CO_2	0.020

Having determined the volume occupied by the precipitate of barium carbonate prepared from the solution equivalent of the sodium carbonate, volumetric gas mixtures of the carbon dioxide were prepared and 1 cc. of the gas mixture was placed in a closed system to which was added 5 cubic centimeters of clear barium hydroxide avoiding air contact. After thoroughly mixing in the closed system the barium hydroxide solution and its contained precipitate of carbonate was carefully run into a Hopkins centrifuge tube, quickly superimposed with 1 cc. paraffine oil and centrifuged. The pure carbon dioxide was generated by adding a dilute mineral acid to a concentrated solution of sodium carbonate. The pure CO_2 thus generated was permitted to enter a completely water filled graduated reservoir from which it could be obtained in definite amounts as needed. A known CO_2 gas mixture was then pre-

pared as follows The graduated vessel containing the pure CO_2 was connected with glass tubing to a liter volumetric flask, the glass tubing extending to the bottom of the flask. Ten cc. mercury was permitted to run into the pure CO_2 chamber which displaced ten cc. of the CO_2 and forced it over to the bottom of the mixing flask. The CO_2 being a heavy gas remains for a short interval at the bottom of the flask permitting the displacement of an equal volume of air at the top. The flask is closed the instant the CO_2 has completely entered. In this way a fairly accurate 1 per cent. CO_2 gas mixture in air is prepared.

Similarly a 2 per cent., 3 per cent., etc., mixture may be prepared. The next step in the analysis consists in mixing the measured gas containing carbon dioxide with barium hydroxide to precipitate the carbonate, for this purpose the Van Slyke apparatus[21] for studying the alkali reserve of the blood was found most suitable. This apparatus combines the advantages of being a mercury pump suitable for drawing the gas into a closed system without loss, is suitably calibrated, permits the subsequent addition of solutions without loss of any of the contained gas, and permits mixing of the gas and aqueous barium hydroxide solution by simply raising and lowering the mercury leveling bulb. In order to transfer the gas mixture to the Van Slyke apparatus use is made of the plan given in the illustrated description diagram using capillary glass and rubber tubing completely filled with mercury to avoid loss of carbon dioxide or change in composition of the gas to be analyzed. The details here are omitted because of the obvious simplicity.

An analysis is performed as follows: The pressure tubing connecting the Van Slyke apparatus and the container of the gas mixture has been clamped close to the gas reservoir. A certain amount of room air is present in the tubing attached to capillary "a". This air is first removed by drawing it into the main chamber of the Van Slyke apparatus by lowering the leveling bulb, then expelling the gas through cup "b". This is repeated until the metallic click is heard, when the mercury is permitted to return, indicating a total absence of air. The screw clamp on the pressure tubing is then removed and exactly one cubic centimeter of gas is drawn into the apparatus as determined when the mercury in the apparatus and in the leveling bulb are level. Six cubic centimeters of clear barium hydroxide are placed in cup "b" and about five cubic centimeters of this are run into the main mixing chamber in such a way that the gas in it is completely retained. This is accomplished by connecting stop cock "e" with cup "b" and gradually lowering the leveling bulb until about one cc. remains in "b" when stop cock "e" is turned off. The mercury leveling bulb is placed in a position slightly lower than the mercury level in the mixing chamber, while the next step is being performed. The barium hydroxide remaining in cup "b" is quickly removed and the cup is twice washed with distilled water, then one cubic centimeter of CO_2 free distilled water is placed in it. The gas and barium hydroxide are then mixed by raising and lowering the mercury leveling bulb gently. The pressure tubing is removed from capillary "a" and the barium hydroxide and

carbonate expelled through this into a Hopkins centrifuge tube. A small amount, of course, remains in the capillary. To wash this out, draw into the main chamber the water placed in cup "a", subsequently adding it to the contents in the Hopkins centrifuge tube; then quickly superimpose one cubic centimeter of paraffine oil and centrifuge at a uniform rate of speed. In this way known CO_2 gas mixtures were prepared, analyzed and the resultant precipitates measured volumetrically with the results given in following chart. (Table 2.)

TABLE 2

Volumetric examination of the precipitate of barium carbonate obtained from carbon dioxide in certain percentage air mixtures

PURE CO_2 DILUTED TO 1 LITRE WITH AIR	CO_2 AIR MIXTURE IN PERCENTAGE	AMOUNT OF GAS USED FOR EXAMINATIONS	VOLUME OF Ba_2CO_3 PRECIPITATE
cc.	*per cent*	*cc.*	*cc.*
0	Atmosphere	1	0
10	1	1	0.002
20	2	1	0.004
30	3	1	0.006
40	4	1	0.008
50	5	1	0.010
60	6	1	0.012
70	7	1	0.014
80	8	1	0.016
90	9	1	0.018
100	10	1	0.020

Each gas mixture was tested at least five times and the results were found to be entirely uniform. The analytical studies for carbondioxide consisted mainly in determining the carbon dioxide content of the gases in culture tubes. The tubes studied were either merely cotton-paraffine stoppered, rubber stoppered or glass sealed. To obtain the gas from the cotton and rubber stoppered tubes a hypodermic needle was attached to pressure tubing, the tubing was clamped just as close to the needle as possible, the needle is inserted through the stopper and the tubing attached to capillary "a" of the Van Slyke apparatus. First the air in the tubing is removed as previously described; then the clamp is opened and the gas drawn into the main chamber. It may then be transferred to a mercury filled reservoir to be utilized as needed. The glass sealed tubes required a slightly different technique to obtain the gas. One end of the tube was scratched with a file and broken under mercury in a suitable dish. The other end was kept in a vertical position by a clamp. A mercury filled capillary tube which had been attached to the Van Slyke apparatus was inserted under the open end and the gas withdrawn into the gas-free Van Slyke apparatus.

THE EFFECT OF CARBON DIOXIDE UPON THE GROWTH AND VIABILITY OF TUBERCLE BACILLI IN CULTURE TUBES.

For determining the effect of carbon dioxide upon the growth of the tubercle bacillus a special culture tube was devised in which a reasonably accurate concentration of carbon dioxide could be generated, as was revealed by numerous preliminary tests and analyses. The essential parts of this culture tube was a six by one inch heavy wall bacteriological test tube in which a uniform slant (10 cubic centimeters) of culture medium is contained with a sterile cotton plug protecting it against contamination. In the mouth of this tube is contained a one-hole rubber stopper (No. 5) into which is inserted the generator tube, a small 4 x ½ inch heavy wall bacteriological test tube, rubber stoppered, and with a small hole about one millimeter in size blown into the side just below the point of insertion into the large one-hole rubber stopper. The purpose of the hole is to allow easy transfer of the gas from the small generator tube into the large reservoir of the culture tube. With a known air space in the large tube above the culture medium enough sodium carbonate can be placed in the generator tube, to which is added an excess of a mineral (dilute sulphuric) acid to generate any amount of carbon dioxide after the medium has been seeded with tubercle bacilli, to give the desired concentration of this gas in air. The procedure was carried out as follows: After planting the tubercle bacilli on the glycerine agar the sterile cotton plug was inserted to a level below that reached by the generator tube. Into the generator tube was placed an amount of sodium carbonate sufficient to give the desired concentration of carbon dioxide in the volume of gas of the culture tube. The one-hole rubber stopper containing the generator tube stoppered with a solid rubber stopper was then carefully inserted into the large culture tube, care being taken to have no leakage around the rubber stoppers. An excess of dilute sulphuric acid was then drawn into a syringe and injected through the rubber stopper of the generator tube into the sodium carbonate. To allow an escape of the contained excess of air a small hypodermic needle was inserted through the large one-hole rubber stopper into the culture tube and was retained there until air equilibrium had been established and the generation of carbon dioxide ceased. The carbon dioxide being a heavy gas, remained in the generator tube, or dropped to the bottom of the large culture tube for a sufficient period to prevent any loss of this gas, and then would slowly diffuse throughout the culture chamber after the gas escape needle had been withdrawn. After removal of both needles the gasses were held in a practically sealed chamber. In the series in which a complete absence of carbon dioxide was desired, one cubic centimeter of a strong sodium hydroxide solution was placed in the generator to absorb the carbon dioxide as it was formed.

In the series in which atmospheric air was used the tubes were merely

stoppered with cotton plugs which had been slightly paraffined and were further covered with paraffine cloth after inoculation. In the series in which pure carbon dioxide was used a continuous stream of pure carbon dioxide, prepared from chemically pure sodium carbonate and dilute sulphuric acid was passed through the rubber stoppered culture tubes, the gas entering by one hypodermic needle and the air passing out of the other until it was reasonably assured that all of the air had been displaced by carbon dioxide, when both hypodermic needles were withdrawn. In this entire cultural study a few factors had to be left to take care of themselves, i. e., the solubility of carbon dioxide in the culture medium, a slight escape of carbon dioxide through the needle used for adjusting the gas to atmospheric pressure and a slow solubility of carbon dioxide in rubber to which Haldane [22] has called attention and which was of some consequence in some of the other experiments to be given in this paper. These factors, however, proved of no importance in this part of the study except in the cases where the carbon dioxide content was over 15 per cent. Here perceptible loss was noted, especially as revealed by the gas analyses at the termination of the experiment. Since, however, the significant findings occurred in concentrations below 15 per cent. these findings proved negligible.

In each gas series, four different strains of tubercle bacilli were studied, an old laboratory culture of avirulent human, a freshly isolated highly virulent human (Blum), an old laboratory culture of avirulent bovine (Bovine D), and a recently isolated culture of virulent bovine bacilli, and of each strain three tubes of 5 per cent. glycerine agar were inoculated except in the case of the virulent human strain (Blum), where six tubes were inoculated on account of its poorer growth ability upon artificial medium (glycerine agar). Observations of the growth were made at weekly intervals for one month at 37.5° Centigrade after which the gas contained in two-thirds of the tubes was analyzed for carbon dioxide and the stoppers removed to allow easy access of atmospheric air and observations continued for another month at incubator temperature to note whether carbon dioxide had merely had an inhibitory action upon the cultures or had actually been tuberculocidal. The results of these cultural studies and analyses are given in Table III.

An examination of Table III reveals that the four strains of human and bovine tubercle bacilli will not grow in the complete absence of carbon dioxide, and that compared with their growth in air upon glycerine agar, air containing as low as 3 per cent. carbon dioxide definitely inhibits their growth, although their viability is not appreciably affected by an exposure to this concentration of carbon dioxide in air for a period of a month. Exposure for a month to the higher concentrations of carbon dioxide, 12 per cent. or more, may be said to be definitely tuberculocidal, however.

During the course of the animal experiments in which sealed and rubber stoppered tubes, small and large, containing recently inoculated cultures of tubercle bacilli upon glycerine agar were used, it was found

TABLE 3

The effect of different gaseous concentrations of carbon dioxide upon the growth and viability of tubercle bacilli

CARBON DIOXIDE CONTENT (VOLUMETRIC) BEFORE INCUBATION	STRAINS OF TUBERCLE BACILLI	NUMBER OF CULTURE TUBES	READINGS AVERAGED AFTER				CO_2 CONTENT OF TUBES AFTER 1 MONTH INCUBATION IN PERCENTAGE VOLUMES	NUMBER OF TUBES ANALYZED AND THEN OPENED	READINGS 2 MONTHS AFTER INOCULATION 1 MONTH AFTER REMOVAL OF CO_2	
			1 week	2 weeks	3 weeks	4 weeks			Air access after removal of CO_2 †	CO_2 still retained
CO_2 free air	Human avirulent	3	−	−	−	−	0	2	+++	−
	Human virulent	6	−	−	−	−	0	3	±	−
	Bovine avirulent	3	−	−	−	−	0	2	++	−
	Bovine virulent	3	−	−	−	−	0	2	+	−
Normal air containing CO_2 (0.04 per cent)	Human avirulent	3	−	++	+++	++++	‡			++++
	Human virulent	6	−	−	±	+	‡			++
	Bovine avirulent	3	−	+	+++	++++	‡			++++
	Bovine virulent	3	−	+	++	++++	‡			++++
3 per cent CO_2 in air	Human avirulent	3	−	−	+	+	3.0*	2	+++	++
	Human virulent	6	−	−	−	−	2.5	3	+++	++
	Bovine avirulent	3	−	+	+	++	3.0	2	++++	+
	Bovine virulent	3	−	−	+	+	3.0	2	+++	+
6 per cent CO_2 in air	Human avirulent	3	−	−	−	−	6.0	2	++++	−
	Human virulent	6	−	−	−	−	5.6	3	−	−
	Bovine avirulent	3	−	−	−	−	6.0	2	+++	+
	Bovine virulent	3	−		−	−	5.5	2	++	−
9 per cent CO_2 in air	Human avirulent	3	−	−	−	−	8.5	2	+	−
	Human virulent	6	−	−	−	−	7.0	3	−	−
	Bovine avirulent	3	−	−	−	−	9.0	2	+++	−
	Bovine virulent	3	−	−	−	−	7.5	2	++	−

12 per cent CO_2 in air	Human avirulent	3	—	—	—	—	11.5	2	—	—
	Human virulent	6	—	—	—	—	11.0	3	—	—
	Bovine avirulent	3	—	—	—	—	12.0	2	—	—
	Bovine virulent	3	—	—	—	—	12.0	2	+	—
15 per cent CO_2 in air	Human avirulent	3	—	—	—	—	14.5	2	+	—
	Human virulent	6	—	—	—	—	14.3	3	—	—
	Bovine avirulent	3	—	—	—	—	15.0	2	—	—
	Bovine virulent	3	—	—	—	—	14.5	2	+	—
30 per cent CO_2 in air	Human avirulent	3	—	—	—	—	28.0	2	—	—
	Human virulent	6	—	—	—	—	30.0	3	—	—
	Bovine avirulent	3	—	—	—	—	24.0	2	—	—
	Bovine virulent	3	—	—	—	—	22.0	2	—	—
Pure CO_2	Human avirulent	3	—	—	—	—	55.0	2	—	—
	Human virulent	6	—	—	—	—	60.0	3	—	—
	Bovine avirulent	3	—	—	—	—	50.0	2	—	—
	Bovine virulent	3	—	—	—	—	68.0	2	—	—

* The figures in this column are the average obtained from all the tubes analyzed in each set.

† Rubber stoppers were removed for one hour to permit escape of carbon dioxide and tubes were then stoppered with paraffine cotton plugs.

‡ No analyses.

that no growth, even with a good growing laboratory strain of bacilli and a possible sufficiency of air, could be obtained. This upon first consideration seemed rather peculiar, but repeated corroborating findings led to the following culture tube incubator experiment in an effort to solve or explain this fact. A large number of eight by one inch heavy walled bacteriological test tubes containing about 15 cubic centimeters of 5 per cent. glycerine agar slanted were divided into the following series, some seeded with tubercle bacilli, an actively growing young strain of human bacilli, and some being kept unseeded as control tubes.

Series 1. Four tubes of five per cent. glycerine agar were sealed in the blast flame after having attained incubator temperature. The purpose of sealing the tubes only after they had attained incubator temperature was to avoid the introduction of a possible pressure factor during the period of incubation, it having been observed previously in preliminary tests that tubes containing bacilli and sealed at room temperature would not grow.

Series 2. Four tubes of five per cent. glycerine agar were brought to incubator temperature and then were securely stoppered with a rubber stopper.

Series 3. Four tubes of five per cent. glycerine agar were inoculated with a strain of human tubercle bacilli, capable of good growth, constricted in the blast flame, were stoppered with a paraffine cotton stopper and covered with a piece of paraffine cloth held in place by a small rubber band.

Series 4. Four tubes of five per cent. glycerine agar were inoculated with the same strain of human tubercle bacilli as Series 3, were brought to incubator temperature (by residence in the incubator for a few hours) and were then glass sealed in the blast flame with all precautions to avoid in any way injuring the bacilli or medium. The primary constricting of the tubes was carried out before the warming of the tubes to incubator temperature (this procedure was performed on all the tubes of Series 3, 4, and 5), and only a small amount of heat was thus necessary to do the final sealing of this series of tubes.

Series 5. Four tubes of plain glycerine agar were inoculated with the same strain of human tubercle bacilli as Series 3, the tube was constricted in its upper portion in the blast flame, brought to incubator temperature and was then securely sealed with a rubber stopper.

Thus the manipulations in this experiment were practically identical in all the series except that some cultures had the free access of atmospheric air and some were sealed by rubber or glass, some tubes were inoculated and others were not.

All the tubes were then placed at incubator temperature for six weeks, after which time the cultural and carbon dioxide findings recorded in Table IV and illustrated by photographs were obtained. It is evident from this experiment that the carbon dioxide given off by the tubercle bacillus itself in sealed tubes can attain a concentration sufficient to inhibit even the initial macroscopic growth of the micro-organism. There

also seems to be definite concentration of carbon dioxide which can be attained in the sealed tubes and which lies at about the five per cent. volume concentration at which all metabolic activity of the tubercle bacillus ceases. If the tubes are sealed by a substance slowly absorbing carbon dioxide, as was pointed out to be the case with rubber by Haldane, the culture can attain a considerable visible growth before the concentration of carbon dioxide becomes sufficiently high to stop the growth.

THE EFFECT OF THE BODY GASES UPON THE GROWTH OF THE TUBERCLE BACILLUS.

In order to study the influence of the gases of the body upon tubercle bacilli under control the following experiments were performed: Since the gases of the body contain about six per cent. carbon dioxide it was reasoned from the *in vitro* experiments with carbon dioxide that culture

TABLE 4

The growth of human tubercle bacilli in tubes sealed and closed with paraffine cotton stoppers

METHOD OF SEALING TUBE	NUMBER OF TUBE	CULTURAL RESULT SIX WEEKS AFTER BEGINNING EXPERIMENT	CARBON DIOXIDE CONTENT IN PER CENT BY VOLUME AFTER 6 WEEKS AT 37.5 C.	
			Inoculated tubes	Uninoculated controls
Paraffine cotton stoppered	1	+++*	Atmospheric air	Atmospheric air
	2	+++	Atmospheric air	Atmospheric air
	3	+++	Atmospheric air	Atmospheric air
	4	+++	Atmospheric air	Atmospheric air
Closed with rubber stopper at incubator temperature	1	+++	Atmospheric air	Atmospheric air
	2	++	5.2†	Atmospheric air
	3	−	5.5	Atmospheric air
	4	−	5.2	Atmospheric air
Glass sealed at incubator temperature	1	−	4.7	Atmospheric air
	2	−	5.2	Atmospheric air
	3	−	5.5	Atmospheric air
	4	−	5.5	Atmospheric air

tubes appropriately prepared to allow easy access of these gases should show a definite inhibition of the growth of the tubercle bacilli.

In the early part of the animal experiments, tubes of glycerine agar seeded with tubercle bacilli were placed in the peritoneal cavity, part of them glass sealed for controls and part of them stoppered with sterile glass wool to keep the body fluids out and with a two-hole rubber stopper to aid in preventing an influx of these fluids. It was soon learned, however, that growth did not occur in either the sealed or the open tubes. In other words, the glass sealed tube did not prove to be a control as

was hoped. It was, therefore, necessary first to devise a method for growing the tubercle bacillus in the animal body which could serve as a control.

After a great many trials the best success was obtained with a large six by one inch heavy wall bacteriological test tube which contained a slant of five per cent. glycerine agar seeded with a young actively growing strain of human tubercle bacilli. This tube was constricted in the blast flame about three inches above the agar slant to a diameter of about ¼ to ⅜ of an inch and the open end flared out. The constricted top of the tube was stoppered with sterile cotton and into this was dropped sterile melted paraffine, not to saturation, however. The top of the tube was then sterilized by gently heating in the flame while the bottom of the tube containing the culture medium and bacilli was sterilized by immersion for five minutes in 90 per cent. phenol, in 95 per cent. alcohol; the phenol being subsequently removed by rinsing in sterile 95 per cent. alcohol; the excess of alcohol drained off and the remainder quickly burned off without, however, permitting the contents of the tube to become more than slightly warm. The tube, thus sterilized, was placed in a sterile light-proof container and kept (not more than a few days) until they were inserted into the subcutaneous tissues of the back of the dog. An incision about one to two inches was made into the skin slightly to the right or left of the mid-line of the back. By blunt dissection a pocket was made subcutaneously sufficiently large to hold the culture tube. These tubes, to have access to atmospheric air, were inserted into this pocket and a small hole made about three inches lateral to the original incision, just large enough to permit the mouth of the culture tube to pass out. Thus the tube was kept away from the primary incision. The tube was then held in place by means of loops of sterile silk worm gut around the neck and just anterior to the place the tube had been drawn out. The operations were performed under ether anesthesia and absolute aseptic precautions.

The buried tubes were prepared similarly to the open tubes except without the flanged end, with paraffine cotton stopper and sterilized, but were inserted into the subcutaneous pocket with open end first so that it would be completely buried in the tissues. To hold the tube in place and away from the incision, stay sutures of silkworm gut were used just constricting the bluntly dissected pocket. In all cases the primary incision thus usually healed early and the skin stitches could be removed in from five to seven days. The stay sutures were not removed until the culture tube was taken out at the end of the experiment. The tubes were allowed to remain subcutaneously for about four to six weeks, when comparison could be made. All the dogs were kept in dark cages during the course of the experiment, to rule out any detrimental influence of light upon the cultures. Thus, the one set of tubes with external opening and access to atmospheric air were incubated in the animal body while the buried tubes were incubated at body temperature and exposed to the tissue gases.

The accidents encountered in these experiments were fairly common and included a sloughing out of the tubes before termination of the experiment, which occurred only in those with external opening, a shaking up of the culture medium, breaking off the tip of the tube, and an infection of the pocket with accumulation of fluid which would flow into and spoil the buried tubes especially. In spite of these difficulties a great many experiments came to term without mishap. About fifty dogs were used in this part of the studies, while in the studies in which tubes were buried intraperitoneally, there were used about twenty-eight dogs. In many of the latter, however, two to three tubes were buried in the same animal, while in the subcutaneous studies each animal received only one tube. In all the animal experiments, however, which terminated without mishap, entirely consistent results were obtained: there was never a growth of the tubercle bacilli upon any of the buried tubes exposed to the tissue gases even after eight weeks, whereas all of the exposed tubes in which easy access of atmospheric air was allowed, through the paraffined cotton stopper, a good growth was obtained within four to six weeks.

THE CARBON DIOXIDE CONTENT OF TUBES BURIED IN THE SUBCUTANEOUS TISSUE.

Since it has been determined that the cultures of tubercle bacilli buried in the tissues of dogs and permitted to acquire the carbon dioxide concentration of the body are inhibited in their growth, it seemed desirable to determine further the approximate carbon dioxide concentration of such buried tubes, and how soon after being put into the subcutaneous tissues the maximum concentration, would be attained under the conditions of experiment used above. For this purpose a set of tubes were prepared that were stopped with a firm paraffine cotton plug as above, and sterile but empty except for the presence of atmospheric air, a second set identical to the first but containing a slant of ten cubic centimeters of sterile five per cent. glycerine agar, and a third set similar to the second but planted with human tubercle bacilli. One of each of these tubes of the three sets were inserted into the subcutaneous tissues of the back of a dog with the open end distal to the incision, the technique being similar to that used in the above animal experiments and at certain intervals the three tubes from one dog were removed, using all possible precautions to avoid gaseous loss while placing the tubes over mercury for subsequent analysis. The gases of the tubes were then carefully analyzed for carbon dioxide content with the result given in Table V.

An examination of Table 5 reveals that the carbon dioxide content of the paraffine-cotton stoppered tubes placed in the subcutaneous tissues of the dog gradually increases until it reaches its maximum of about five per cent. after forty-eight hours, which is then maintained.

TABLE 5

The carbon dioxide content of culture tubes buried in the subcutaneous tissues after certain intervals

DESCRIPTION OF TUBE*	PERIOD OF TIME IN HOURS DURING WHICH TUBES WERE BURIED BEFORE ANALYSIS FOR CARBON DIOXIDE CONTENT						
	1.5	3	6	24	48	72	144
	per cent	*per cent*	*per cent*	*per cent*	*per cent*	*per cent*	*per cent*
Empty sterile test tube stoppered with paraffine-cotton	2.0†	1.3	1.7	2.7	4.7	5.0	—
Sterile tube containing a slant of 5 per cent glycerine agar stoppered with paraffine-cotton	Lost‡	1.7	2.0	2.3	5.0	Lost	4.7
Sterile tube containing a slant of 5 per cent glycerine agar inoculated with human tubercle bacilli and stoppered with paraffine-cotton	1.3	Lost	Lost	2.7	5.3	4.7	—

SUMMARY AND CONCLUSIONS

Humoral antibodies have failed to explain resistance to tuberculosis, the lymphocyte as the important factor is rapidly being discarded allergic phenomena require further elucidation, the phagocytic action of the wandering cell is recognized as important. But both humoral and cellular mechanisms of resistance leave much to be explained.

Weber's empiric reasoning that the deficiency of carbon dioxide in the body favors tuberculosis, while an accumulation retards the progress of the disease, seems to be highly significant, but his avowed sublime contempt for laboratory procedures precluded his opportunity of crystallizing the conception in so far as it deprived him of the specific data essential to substantiate his theories, further it led him into some crude basic biochemical blunders; however, his main empirically reasoned principles appear to be substantiated by our experimental work.

We have observed that three per cent. carbon dioxide causes some inhibition of the growth of the tubercle bacillus in the test tube and fifteen per cent. is tuberculocidal. Tubercle bacilli will not grow in a carbon dioxide free atmosphere.

Cultures of tubercle bacilli buried in the tissues of animals and permitted to acquire the carbon dioxide concentration of the body are definitely inhibited in their growth, while other cultures similarly buried, except that ingress of atmospheric air is permitted, show no inhibition.

When viable tubercle bacilli are placed in a closed system, their growth becomes inhibited as the carbon dioxide which the organisms elaborate approaches a concentration of approximately 5.5 per cent.; at which concentration respiration of these micro-organisms is also reduced to a minimum. In a closed system the end products of metabolism automatically

inhibit the growth of the organisms that give rise to them. This, of course, holds true in a measure for all biological growth phenomena, namely, that the end products of metabolism, if permitted to accumulate, will attain a concentration at which they become toxic to the organisms elaborating them and consequently inhibit their growth, and later may even destroy them.

The significant feature of this study with the tubercle bacillus is that the concentration sufficient to inhibit definitely its growth, namely 5.5 per cent., occurs normally in the human body; and the experiments conducted both in the test tube and in the animal body indicate that this concentration actually does inhibit the growth of the tubercle bacillus.

It appears, therefore, that this factor is extremely significant in the rôle of resistance to tuberculosis infection and the subsequent development of the disease in the body; further, that the normal body apparently possesses, by virtue of containing sufficient carbon dioxide, the ability to inhibit the growth of the tubercle bacillus. Experiments are now in progress to study further phases of this problem.

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STUDIES WITH MORPHINE IN EXPERIMENTAL TUBERCULOSIS

By H. J. Corper, M.D., H. Gauss, M.D., and O. B. Rensch, M.D.

Denver

The modern treatment of tuberculosis based upon the triad — rest, food, fresh air — remains the essential rational therapeusis since Bodington in 1840 emphasized these major points. However, some important adjuvants have been added — artificial pneumothorax, the orthopedic immobilization procedures and operative measures, i. e., Albee's Bone Graft treatment of Pott's disease, the postural treatment of pulmonary tuberculosis advocated by Webb and his colleagues, the recent chest belt advocated by Sewall and the sedative drugs — all measures to produce localized rest and thus limit the disease. So, too, could be added the important though often neglected nutritional discoveries, the value of antiscorbutics and vitamines, and the proper use of sun and artificial light treatment. The abuse of any of these or their misuse by unintelligent hands may in all cases be disastrous. One would be radical to condemn these procedures because they have failed in the hands of the untrained who are unable to recognize the contraindications to their use.

Opium, and its derivatives, is one of the most condemned drugs; however, in proper hands it is one of the most valuable therapeutic agents that we have. Its abuse justly deserves the highest condemnation of all. Mr. Ng Poon Chew, a leading Chinese editor of this country, is quoted as saying, "The opium question is a very, very serious one. It is much like the whisky question — with this difference: whisky arouses a man's animal instincts and makes him an unreasoning brute; opium deadens his sensibilities and lessens his vitality and transforms him into a living corpse. An American whisky drinker goes home and kicks his wife; an opium fiend goes home and his wife kicks him."[1] Thus a layman pictures the absolute relaxation attained with opium — namely, "a living corpse." David Macht,[2] in an article written on the history of opium and some of its preparations and alkaloids, states that "if the entire materia medica at our disposal were limited to the choice and use of only one drug, I am sure that a great many, if not the majority, of us would choose opium." Macht also points out that although the Chinese are famed for opium smoking, opium is supposed to have been brought to China first by the Arabs about the ninth century, but it was not until the second half of the eighteenth century that the importation began to increase rapidly

through the hands of the Portuguese, and a little later through the famous East India Company.

Morphine, one of the principal alkaloids of opium, was discovered by Sërtürner, who in 1805 reported that a base morphinum was combined with "meconic acid" in this material. In 1816 he gave a detailed account of his work and described the chemical as well as the pharmacologic properties of morphine, which he tested out on himself with the result that he nearly lost his life. Courtois is claimed by Toraude to have discovered morphine in 1804, and to have been deprived of his discovery by his lack of confidence and exaggerated modesty.[3] Narcotin was discovered really before morphine, in 1803, by the French pharmacist, Derosne, who obtained crystals while diluting a syrupy aqueous extract of opium. These crystals became known as *sel d'opium* of Derosne. Their basic or alkaloid character was not established until 1817, by Robiquet, who also discovered codein in 1832. In 1832 Pelletier discovered the opium alkaloids narcein and oxymorphin.

Up to the present opium has yielded 22 different alkaloids, according to Macht. Opium on the market may contain 3 to 18 per cent. of morphine, 1 to 10 per cent. narcotin and 1 to 2 per cent. of codein, with traces of a large number of other alkaloids which have been isolated from this mixture.[4] The analgesic (cutaneous sensation) value for man of six of the opium alkaloids[5] ranged in the following order beginning with the strongest and ending with the weakest: Morphine (10 mg.); papaverin (40 mg.); codein (20 mg.); narcotin (30 mg.); narcein (10 mg.); thebain (10 mg.). Morphine in certain individuals may have the opposite action and render them hypersensitive to pain; combination of morphine with narcotin prevented this. A combination of morphine and narcotin, and also of the total opium alkaloids, is much more effective than the quantity of morphine they contain would be if given alone.

In man after small doses (4 to 6 mg.) of morphine there is generally a primary stage of quickened reaction time;[6] this may or may not be followed by a secondary stage of depression as indicated by narcosis and prolongation of the reaction time. After large doses (over 8 mg.) of morphine, the primary stimulation stage is very short and may be overlooked, whereas the secondary or stage of depression is predominant. Next to its narcotic and pain-relieving action, perhaps the most important action therapeutically and certainly the most striking toxicologically is its action on the respiration. The mode of action of the opium alkaloids upon the respiration is by no means necessarily a simple one, according to Macht.[7] It may stimulate or depress the medullary respiration center directly; it may indirectly affect respiration by modifying the metabolism and thus altering the need of receiving or discharging the respiratory gases; it may act indirectly through the circulatory changes produced in the nervous tissues; and the action may be altered by mechanical conditions which necessitate a modification of the mode of respiration so that it becomes rapid or shallow, slow or deep, or otherwise. The rate of respiration is markedly slowed by morphine, an effect imitated by

codein, but to a much lesser degree. Narcotin and papaverin decrease the rate only slightly, while narcein, thebain and cryptopin do not decrease it at all. In large doses the last five alkaloids may act as distinct respiratory stimulants. The action of combinations of the opium alkaloids on respiration is a summation of their individual effect.

Probably the most serious drawback to the use of morphine is its conspicuous and deplorable habit-forming quality, associated with an enorm-

TABLE 1.

The growth of human tubercle bacilli upon glycerol agar containing morphine sulphate

AMOUNTS OF MORPHINE SULPHATE IN 10 CC. OF GLYCEROL AGAR	CULTURE OF TUBERCLE BACILLI	NUMBER OF TUBES INOCULATED	READINGS AFTER			
			One month	Two months	Three months	Four months
mgm.						
65.0	"Old human"	3	—	—	—	—
	"Pasternack"	5	—	—	—	—
32.5	"Old human"	3	—	—	—	—
	"Pasternack"	5	—	—	—	—
16.2	"Old human"	3	—	—	+	+
	"Pasternack"	5	—	—	+	+
8.1	"Old human"	3	—	—	++	++
	"Pasternack"	5	—	—	++	+++
4.0	"Old human"	3	—	—	+++	+++
	"Pasternack"	5	—	+	++++	++++
2.0	"Old human"	3	—	++	++++	++++
	"Pasternack"	5	—	+++	++++	++++
1.0	"Old human"	3	—	+++	++++	++++
	"Pasternack"	5	—	++++	++++	++++
0.5	"Old human"	3	+	++++	++++	++++
	"Pasternack"	5	+	++++	++++	++++
0.25	"Old human"	3	+	++++	++++	++++
	"Pasternack"	5	+	++++	++++	++++
0.12	"Old human"	3	++	++++	++++	++++
	"Pasternack"	5	++	++++	++++	++++
0.06	"Old human"	3	++	++++	++++	++++
	"Pasternack"	5	+	++++	++++	++++
None	"Old human"	3	++	++++	++++	++++
	"Pasternack"	5	++	++++	++++	++++

ously increased tolerance for the drug. The exact mechanism of this is still unsolved, although various suggestions have been offered. Faust[8] suggested as a result of studies on dogs that the oxidative powers of the body for morphine are increased, since the accustomed animals no longer excrete morphine in the feces, more of the poison being destroyed in the tolerant organism. That this cannot be the sole factor, however, was shown by Rubsamen,[9] who found that after large injections, immune rats still contained enough undestroyed morphine to kill normal rats. This discovery led Cloetta[10] to assume that there must be a tissue immunity factor concerned, which, however, is lost very rapidly by the animal, this being in accord with the general experience among human addicts. Pigeons and rats accustomed to tolerate 0.15 gram of morphine will succumb to this dose as soon as two days after the withdrawal. Von Egmond[11] and Van Dougen[12] found that it is possible to accustom the respiratory center to morphine, while in tolerant dogs the nervous centers concerned in the characteristic dilatation of the pupils may become entirely immunized to the drug. Other centers, for example the vagus center, are not so easily affected. The relative readiness with which the different centers become unresponsive by no means corresponds to their comparative normal sensitiveness. He believes a specific tissue immunity exists in the tolerant animal. Recently Pellini and Greenfield[13] have failed to transfer a tolerance to animals by the injection of the blood serum of tolerant human beings, besides being unable to find any protective substances against morphine in the blood serum of tolerant animals.

Homberger and Munch,[14] in studying the effect of embalming upon the morphine content of the organs of cats and dogs given injections into the mesenteric circulation, found that three hours after injection, when the animals were chloroformed and analyzed, the urine contained the largest single amount of the morphine and the organs can be ranked as follows according to morphine content; liver, kidneys, spleen and stomach. In rabbits the order of content was kidneys, liver, urine, spleen and stomach. The discovery that the urine contains the greatest quantity of morphine is in agreement with that of Van Kaufmannasser, of Van Ryn and of Dorlencourt, who analyzed rabbits killed with morphine. It is believed by Homburger and Munch that part of the morphine combines with some cell constituent, forming a compound which is relatively more resistant to decomposition than the uncombined morphine. The loss of morphine from a cadaver proceeds in two stages, a preliminary drop due to the splitting up of the "free" morphine present, then a period during which the morphine content is fairly constant, followed by a secondary drop, due to a splitting up of the "combined" morphine. The "secondary" decomposition is greatly retarded by embalming, although there seems to be no effect on the preliminary disappearance.

Tamura[15] studied the effect of the oxidation products of morphine and believes his data indicate that the paralyzing action of morphine is due to the alkaloid itself, while the stage of excitement is due to some products of its disintegration.

TABLE 2

The effect of the growth of tubercle bacilli on the morphine content of the medium upon which they have grown

AMOUNT OF MORPHINE SULPHATE IN 10 CC. OF GLYCEROL AGAR	CULTURE OF TUBERCLE BACILLI*	READINGS AFTER					RESULTS OF ANALYSIS FOR MORPHINE SULPHATE AFTER 10 WEEKS
		Two weeks	Four weeks	Six weeks	Eight weeks	Ten weeks	
mgm.							*mgm.*
65.0	"Pasternack"	—	—	—	—	—	62.7
	"Bovine"	—	—	—	—	—	61 6
32.0	"Pasternack"	—	—	—	—	—	31.5
	"Bovine"	—	—	—	—	—	27.2
16.0	"Pasternack"	—	—	—	—	—	15.5
	"Bovine"	—	—	—	—	+	15.3
8.0	"Pasternack"	—	—	—	+	+	7.6
	"Bovine"	—	—	—	+	++	7.8
4.0	"Pasternack"	—	—	+	+	+	3.5
	"Bovine"	—	—	+	++	++	3.7
2.0	"Pasternack"	—	—	+	+	++	1.37
	"Bovine"	—	+	++	++	+++	1 17
1.0	"Pasternack"	—	+	+	++	++	0.56
	"Bovine"	—	+	+++	+++	+++	0.53
0.5	"Pasternack"	—	+	++	++	+++	trace
	"Bovine"	—	++	+++	++++	++++	trace
0.25	"Pasternack"	—	+	++	++	++	0.0
	"Bovine"	—	++	+++	++++	++++	0.0
0.12	"Pasternack"	+	+	++	++	++	0 0
	"Bovine"	+	++	+++	+++	++++	0.0
None	"Pasternack"	—	+	++	+++	+++	0 0
	"Bovine"	+	++	++++	++++	++++	0.0

* Three tubes of each culture were inoculated and analyzed.

Regarding the destruction of morphine in the body, Cloetta[10] believes that in this destruction the oxydative processes play the main rôle and a ferment action is to be excluded. Morphine injected into animals is transported by the plasma, where it may be found for only a short time (about twenty minutes). The blood itself has no power to destroy the morphine but carries it to the various organs. The brain is free from it and the

liver contains a considerable amount *in vivo* after injection. *In vitro* brain, lung, muscle and liver destroy morphine during antiseptic autolysis, while pus (leucocytes) does not destroy it. The organs, and especially the brain of tolerant animals, possess an increased power over normal organs *in vitro* to destroy morphine. Five minutes' heating at 65° centigrade removes the morphine-destroying power of liver tissue.

In the hope of being able to solve the mode of destruction of morphine in the body Grüter[17] studied its destruction in fertile and non-fertile chicken eggs. Fully developed chick embryos completely destroy heroin, morphine to the extent of 50 to 100 per cent., and codein not at all. Increased oxygen supply during incubation did not materially influence the destruction over that attained in air, but a diminished supply or complete oxygen removal prevented destruction. If only one-half the development of the egg was attained, and then death occurred, no destruction of the alkaloids occurred, indicating that a certain developmental condition is necessary to attain destruction of these alkaloids. The injected embryos are to be viewed as chemically poisoned individuals and by analogy with tolerance in grown animals only morphine and heroin were destroyed, but not codein. The destruction of the alkaloids by the completely developed embryo as deduced from the varied oxygen supply experiments is the result of oxidation. Grüter concludes that the important factor in the destruction of these alkaloids is that the chick embryo has attained a certain stage of development of its cell system and in this oxidation is also an important essential. He also believes that there is a correlation between the higher development of the brain of various animals and the ease with which tolerance is developed.

Palet[18] found morphine to resist putrefaction well since he found it to be present in tissues seven months after death in a chronic addict. The effect of morphine upon the lower micro-organisms has been little studied so that the data in the literature is sparse and wanting in detail. Norgaard[19] found that certain molds (aspergillus, acaulium brevicaule, penicillium adbidum, p. glaucum and p. cavescens), yeast (torulæ and saccharyomycetes) and bacteria (staphylococci), would grow upon ordinary morphine solutions, while Takenaka[20] found that morphine and opium in ordinary dilutions were inert toward growing tubercle bacilli while in concentrated solutions they were inhibitory to the growth of these bacilli.

The opium alkaloids have been advocated on numerous occasions for use in pulmonary tuberculosis. As early as 1891 Dill[21] recommended modified opium smoking mixed with tobacco in pulmonary tuberculosis not as a "cure for consumption" but as a palliative and an antidote treatment, not as a substitute for the treatment which professional skill and experience have been led to adopt but as a possible aid to it. Van Marter's[22] experience with the modified opium smoking advocated by Dill led him to conclude "that it seldom harms and often does much good." Solomon Smith[23] states: "It may be taken as a broad rule that in the treatment of phthisical cough sedatives should not be mixed with cough mixtures to be taken frequently, but

that when required they should be given in sufficient doses, not merely to mitigate, but for the time to cure cough, and so give a period of rest, and that before giving them all proper measures should be taken to remove reflex causes of irritation." Sakorrafos[24] believes as a result of his experience in using morphine on patients that this drug is a valuable medicament in tuberculosis. Gaussel[25] obtained good results in tuberculosis with pantopon, a mixture of 50 per cent. morphine and 40 per cent. of the other alkaloids of opium.

Appreciating the sedative action of opium, acknowledging the importance of rest in tuberculosis, and cognizant of the beneficial results reported by clinicians from the use of sedatives in pulmonary tuberculosis, we undertook the study of the effects of morphine upon experimental tuberculosis to determine if we could observe any improvement in the experimentally produced tuberculosis following its administration. The direct action upon the tubercle bacillus was also observed.

TABLE 3

The effect of beef liver in vitro upon morphine sulphate

TIME INTERVAL OF INCUBATION UNDER TOLUOL AS ANTISEPTIC	MORPHINE SULPHATE RECOVERED IN MILLIGRAMS FROM THE	
	Heated tissues	Fresh tissues
One minute	4.86	4.83
Ten minutes	4.95	4.00
Twenty minutes	4.64	3.77
Thirty minutes	4.82	3.39
One hour	4.74	2.84
Two hours	4.54	2.77
Five hours	4.60	2.71
Sixteen hours	4.63	2.63
Seventy-two hours	4.91	2.36

THE EFFECT OF MORPHINE UPON TUBERCLE BACILLI IN CULTURES

The studies to be reported in this paper are entirely experimental and concern the effect of the tubercle bacillus on morphine, the effect of morphine on the tubercle bacillus, and its effect upon experimental tuberculosis in the guinea-pig. Morphine even in saturated solution is not tuberculocidal for short intervals of time up to three days. To determine whether, however, morphine in soluble salt form as sulphate has an inhibitory influence upon the growth of tubercle bacilli the following experiments were performed.

To a series of bacteriological test tubes containing ten cubic centimeters of sterile five per cent. glycerol agar were added varying amounts of pure sterile morphine sulphate (Powers and Weightman, Philadelphia) from 0.06 to 65.0 milligrams. After mixing the constituents well the

glycerol agar containing the morphine was slanted and inoculated with cultures of human tubercle bacilli, an avirulent culture "Old Human" and a virulent culture "Pasternack." These tubes were then incubated at 37.5° centigrade and examined after intervals of one, two, three and four months' incubation and the growth recorded with the results given in Table I.

An examination of Table I reveals that morphine sulphate in amounts as small as one milligram incorporated in ten cubic centimeters of glycerol agar completely inhibit the growth of human tubercle bacilli during the first month of incubation; during the second month growth occurs in the four milligram concentration and during the third month and thereafter in the sixteen milligram concentration. Above sixteen milligrams of morphine sulphate there seems to be a definite complete inhibition of growth. The explanation of this step-like graduation of growth during the different months savors either of the tolerance to morphine noted in mammals or else it would seem that the tubercle bacillus is capable of actually destroying this activity of morphine and its salts. In order roughly to determine whether morphine was still present chemically in the culture medium at the termination of the experiment after four months, approximate quantitative analyses for morphine were made of the contents of a number of the tubes. Within the accuracy of the quantitative method used in the experiments at the time the major part of the morphine seemed still to be present in the medium. Approximately from 80 in the larger amounts (down to the 16 milligram concentration) to 60 per cent. in the smaller amounts (down to the 2 milligram concentration) was recovered.

In order, however, to study this point in greater detail a quantitative colorimetric method was developed which was reported elsewhere[26] giving a quantitative accuracy from 0.10 to 50.0 milligrams of morphine sulphate in collodial mixtures and tissues and an extinction point approximately down to 0.003 milligram. Using this method for the analyses and repeating the experiment given in Table I, but using in addition to the human tubercle bacilli a culture of bovine tubercle bacilli, the results given in Table II were obtained.

A careful examination of the findings depicted in Table II reveals again this step-like gradation of the growth of both the human and bovine tubercle bacilli upon the glycerol agar containing the morphine sulphate in amounts varying from 65 milligrams in ten cubic centimeters of agar to as low as 0.12 milligram. The analysis of the agar containing the morphine sulphate for this alkaloid at the end of ten weeks reveals an almost quantitative recovery of the morphine, so that the evidence obtained in this experiment would not seem to indicate that the tolerance could be explained on the basis of a destruction of the morphine by the tubercle bacillus.

In view of the fact that certain mammalian tissues *in vitro* were found in other studies capable of destroying the chemical entity of morphine to such an extent at least that its recovery by the ordinary methods of analyses was not possible, whether this change was due to oxidation or

disintegrative changes was not determined (as indicated for beef liver in Table III) made it seem highly desirable to determine whether tubercle bacilli *in vitro* could also destroy the chemical entity of morphine sulphate.

THE EFFECT OF BEEF LIVER AND TUBERCLE BACILLI UPON MORPHINE SULPHATE *IN VITRO*

The Effect of Beef Liver Upon Morphine Sulphate

Into each of eighteen small sterile flasks were placed five grams of ground fresh beef liver and to this was added five cubic centimeters of sterile water. The contents of nine of these flasks was heated for at least 30 minutes in a boiling water bath, and when cool a solution of morphine sulphate containing five milligrams and one cubic centimeter of toluol was then added to all the flasks. After shaking well one of the flasks containing the heated tissue and one containing the unheated tissue were analyzed to determine the amount of morphine sulphate remaining unchanged after intervals from one minute to seventy-two hours' incubation at 37° centigrade, with the results given in Table III. The flasks were frequently shaken and sufficient toluol kept in them.

It is noted from this experiment with beef liver that this tissue *in vitro* is capable of changing morphine sulphate chemically to such an extent that it cannot be recovered quantitatively by the method used.

The Effect of Tubercle Bacilli Upon Morphine Sulphate in Vitro

In view of the fact that beef liver tissue is capable of destroying the chemical integrity of morphine sulphate, as seen from the above experiment, it seemed desirable to determine whether the tubercle bacilli possessed this same power. For this purpose 50 grams of human and bovine tubercle bacilli (strains Miller [human], Knight [human], 4015 [human], Pasternak [human], a bovine avirulent and a bovine virulent) were removed with all aseptic precautions from the surface of the medium of glycerol agar culture and placed in a sterile flask containing 40 cubic centimeters of sterile 0.9 per cent. Na Cl solution. After mixing well and breaking up all the lumps, the equivalent of 5 grams of the tubercle bacilli was placed into each of ten small sterile flasks. Four of these flasks were heated in a boiling water bath for 30 minutes to destroy the enzymes present in the tubercle bacilli and after cooling to room temperature, 5 milligrams of morphine sulphate in sterile solution and one cubic centimeter of sterile toluene were added to the ten flasks containing the heated and unheated bacilli. The flasks, cotton stoppered, were then carefully capped with heavy tin foil to prevent loss by evaporation and were incubated at 37° centigrade with frequent agitation and maintaining the presence of toluene for the entire period of incubation up to fourteen days. At certain intervals the flasks were removed from the incubator and ten volumes of three per cent. trichloracetic acid solution added, shaken and the mixture heated in a boiling water bath for thirty minutes. Upon cool-

ing the content of the flask was filtered, the precipitate washed at least five times with distilled water and the entire filtrate analyzed for morphine by the method previously described. The results of this study are given in Table IV.

An examination of Table IV reveals that, like beef liver, tubercle bacilli possess the power of destroying the chemical entity of morphine sulphate; at least they alter this compound to such an extent that it cannot be recovered by the method of analysis used in these studies. To all intents and purposes this action seems to be enzymatic in nature, since it is destroyed by heating the bacilli in a boiling water bath for 30 minutes.

TABLE 4

The effect of tubercle bacilli in vitro upon morphine sulphate

TIME INTERVAL OF INCUBATION USING TOLUENE AS ANTISEPTIC	MORPHINE SULPHATE RECOVERED IN MILLIGRAMS FROM THE	
	Heated tubercle bacilli mixture	Living bacilli mixture
One minute	4.80	4.78
One hour	—	3.43
One day	4.88	2.77
Four days	—	2.93
Seven days	4.65	2.86
Fourteen days	4.73	2.63

THE EFFECT OF MORPHINE UPON TUBERCULOSIS IN THE GUINEA PIG

Since morphine and its associated alkaloids probably have many properties either beneficial or detrimental still remaining to be discovered by the physiologist, and in view of its admitted hypnotic and sedative action, it seemed well worth while to determine what effect, if any, morphine would have upon experimental tuberculosis. So far as the available literature would indicate no such studies have ever been made. Before, however, entering upon the therapeutic experiments it seemed well worth considering whether morphine as such could be considered as a direct therapeutic agent.[27]

In a series of experiments in which morphine sulphate was administered subcutaneously to guinea-pigs in amounts as large as 60 to 100 milligrams daily for a period as long as six weeks, and certain organs (the liver, lungs, spleen, brain, muscle and kidneys and tuberculous glands) analyzed for the presence of morphine, there was found to be no accumulation of morphine in any of these organs or in the tuberculous glands, and within twenty-four hours after the last injection these tissues were entirely free from morphine in chemical form capable of demonstration. In view of this fact and the previously given cultural data it would seem highly im-

probable that this compound could have any direct therapeutic action in tuberculosis.

Since, however, there are no doubt other factors instrumental in retarding or hastening the progress of this disease in man and animals, and since morphine seems to possess properties which could be considered advantageous under certain conditions, a study of the indirect effect of morphine upon experimental tuberculosis seemed desirable.

For this purpose a series of guinea-pigs of uniform weight and all males were infected by injecting subcutaneously into the left groin small

TABLE 5

The effect of small daily doses of morphine sulphate, given subcutaneously, upon tuberculosis in the guinea pig

TREATMENT*	CULTURES AND INFECTING DOSE USED			
	Pasternack		Maxfield	
	0.000,1 mgm.	0.000 000,1 mgm.	0.000,1 mgm.	0.000,000,1 mgm.
Controls (no treatment)	+++†	++	- +	++
	+++	+++	++	Died
	++++	+++	++	Died
Eight milligrams morphine sulphate daily begun five days before infection and continued	++	++	++	+
	++	++	++	+
	+++	Died	+	+
Eight milligrams morphine sulphate daily given coincident with infection and continued	+++	++	++	+
	+++	++	++	+
	++	+	Died	+

* All the guinea pigs were sectioned twenty-four days after infection.

† The markings in this table conform with those previously reported from this laboratory and are as follows:

\+ distinctly enlarged local (left inguinal) and slightly enlarged iliac lymph nodes.

++ enlarged inguinal and iliac nodes and slight involvement of the spleen.

+++ enlarged inguinal and iliac nodes, spleen markedly involved, tracheobronchial nodes enlarged and the lungs slightly involved.

++++ massive involvement of all important lymph nodes in path of infection, spleen, lungs and liver.

— no visible macroscopic tuberculosis.

amounts (0.000,01 to 0.000,000,001 milligram)[25] of virulent human tubercle bacilli; some of these animals received no treatment and some of them received daily subcutaneous injections of morphine sulphate (8 milligrams) beginning one week before infection and continued to the termination of the experiment; in others the morphine injections were begun coincident with infection, and in another set the morphine injections were begun one week after infection. These animals were examined for the amount of tuberculous involvement in from five to seven weeks after

infection, with the results given in Table VI. This experiment was suggested as a result of a preliminary experiment in which two different cultures of human tubercle bacilli ("Pasternak" and "Maxfield") were used for infecting and the period of study after infection was only of short duration. In this experiment there seemed to be a slight retarding influence of the morphine treatment upon the tuberculosis in the guinea-pig. These results are given in Table V.

An examination of Tables V and VI reveals that small amounts of morphine sulphate (8 milligrams) given to guinea-pigs daily before and during the early part of the infection (24 days and five weeks) has a slight

TABLE 6

The effect of daily injections of small doses (8 mgm.) of morphine sulphate upon tuberculosis in the guinea pig

AMOUNT OF TUBERCLE BACILLI (CULTURE MAXFIELD) INJECTED	INTERVAL BETWEEN INFECTION AND SECTION IN WEEKS	TREATMENT WAS BEGUN WITH RELATION TO INFECTION			
		Controls not treated	One week before	Coincident	One week after
mgm.					
0.000,01	Five	++*	+	++	
		+++	++	+	
		++	+	+	
			+	+	
0 000,000,1	Six	+	+	+	
		+	+	(±)	++
		+	++	+	++
			+		
0.000,000,001	Seven	+	++	++	+
		+	+	++	++
		+	+	+	
				++	

* The gradings of tuberculous involvement are from — to ++++ as given in footnote to table 5.

inhibitory effect upon the development of tuberculosis in these animals while a prolonged period of treatment exceeding five weeks may not have an appreciable effect.

In view of these slight but rather encouraging results in the animal experiments it seemed worthy to repeat these studies and also to note the effect of the administration of larger doses of morphine sulphate given intermittently, i. e., 130 milligrams given daily for three days and then a three days' rest period followed by three days' treatment throughout the entire four weeks of infection. Daily injections of this amount of morphine sulphate for several weeks were found in preliminary experiment to be inconsistent with the life of the guinea-pig. This was done and the

TABLE 7

The effect of large doses of morphine sulphate, injected into guinea pigs, upon the development of tuberculosis

SERIES AND CULTURE	AMOUNT OF BACILLI USED FOR INFECTING	CONTROLS	TUBERCULOUS INVOLVEMENT	
			Subcutaneous injection of morphine sulphate	
			Large dose	Small daily doses (8 mgm.) daily throughout infection
			130 mgm. daily for 3 days followed by a 3 day rest and repeated throughout infection	
	mgm.			
Series 1. Four weeks infection period with culture "Maxfield"	0.001	+++*	++	+
		+++	++	++
		+++	++	+++
	0.000,1	++	+	++
		++	+	+
		++	+	
	0.000,01	++	+	+
		++	+	+
		++		+
			Intermittent 3 days (130 mgm.)	Continuous daily (65 mgm.)	
	mgm.				
Series 2. Seven weeks infection period with culture "Levinson"	0.001	++++	++++	++++	++
		+++	+++	++++	+++
		++++	++	++++	++++
		+++			++
		++++			+++
		+++			+++
	0.000,01	++	+++†	+++	++
		+++	+	++	+++
		++		++	++
		+++		++	++++
		++			++
		+++			++
	0.000,000,1	+++	+++	+++	+++
		+++	+++	++	+++
		+	+++	+++	+++
		+++		++	+++
		+++			+++
		++			

* The grading of tuberculous involvement from — to ++++ is the same as in tables 5 and 6.

† With the larger doses of morphine sulphate a number of the guinea pigs in the series died before the termination of the experiment and are not recorded.

results are incorporated in Table VII, which also includes a study extending up to seven weeks after infection (Series II).

An examination of Table VII reveals that the slight inhibitory effect of the morphine sulphate upon the tuberculosis in the guinea-pigs, which is seen best in the early part of the infection up to four weeks, to a great extent disappears if the period of treatment and observation is extended to seven weeks.

In an attempt to seek the explanation for this slight inhibitory effect of the morphine sulphate upon the tuberculosis in the guinea-pig during the early stages a number of possibilities suggested themselves. One of these was that it may be a purely chemical action such as is seen in the effect of morphine upon the alkali reserve of the blood. Hjort and Taylor[29] found that morphine sulphate administered subcutaneously to normal dogs in doses of 10 milligrams caused an increase in the alkali reserve which is maintained at a high level for some hours, while our experiments[30] indicated that morphine administered subcutaneously in the form of sulphate to rabbits, dogs and sheep distinctly increased the alkali reserve of the blood plasma of these animals. Likewise there was a slight but distinct effect upon the pH of the blood plasma. Excitement in dogs and rabbits decreased the alkali reserve of the blood plasma. Repeated short interval injections of morphine did not tend to have a greater effect than a single injection. In man given a therapeutic or slightly toxic dose, morphine did not have a marked effect when administered subcutaneously (in dose from 16 to 32 milligram) upon the pH or the alkali reserve of the plasma.

SUMMARY

Clinicians have reported beneficial results from the use of sedatives in tuberculosis. There are repeated instances in the history of medicine where drugs first employed empirically have later been shown to have a direct action in the disease for which they have been employed and in some instances have even proved a specific — quinine is one of the best examples. Opium and its derivatives have much in their favor to recommend them therapeutically in tuberculosis. Their pronounced sedative action is entirely consistent with the great principle of rest in the rational therapeusis of this disease, nevertheless it is quite true that other properties of these drugs may form equally strong contraindications for their use.

This study is concerned with the action of morphine on the tubercle bacillus and upon experimental tuberculosis in the guinea-pig. Morphine even in saturated solution is not tuberculocidal for short intervals of time up to three days, whereas it does exercise a distinct inhibitory action upon the growth of the bacilli. The results indicate that morphine sulphate in amounts as small as one milligram incorporated in 10 cubic centimeters of glycerol agar completely inhibits the growth of human tubercle bacilli during the first month of incubation (morphine diluted to 1 part in 10,000), during the second month growth occurs in the four milligram concentra-

tion, whereas after three months it occurs in sixteen milligram concentration. Above sixteen milligrams (morphine diluted to 1 part in 625) there appears to be complete inhibition of growth. The ability of the tubercle bacilli to grow in increasing concentrations with increased time is interesting and suggests the possibility of a morphine tolerance or morphine destruction.

The morphine was recovered from the culture tubes practically quantitatively, whereas when morphine was mixed with a suspension of tubercle bacilli it was destroyed to a much greater degree quite similar to the destruction action exercised by fresh liver tissue. When a quantity of morphine sulphate is mixed with emulsions of tubercle bacilli or liver cells, about half is so altered chemically that it can no longer be identified after twenty-four hours' incubation. Appreciably longer periods of incubation do not increase the amounts destroyed. There is much in this to suggest a ferment action. Further experiments are being conducted on this phase of the problem.

In experimental tuberculosis in the guinea-pig, small amounts of morphine sulphate (eight milligrams) administered daily before and during the early part of the infection have a slight inhibitory effect upon the development of the tuberculosis in these animals, while prolonged treatment exceeding five weeks after infection has little or no effect.

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DISCUSSION ON PAPERS BY DR. CORPER, DR. GAUSS AND DR. RENSCH

Dr. Alfred Meyer, New York: May I first make a personal remark, and congratulate the National Jewish Hospital for Consumptives for having on its staff, in the youth of its research laboratory, a young man, well grounded in chemistry and in bacteriology, who has the imagination of a research worker and at the same time the judicious temperament to judge the evidence of his work. I believe that you will all agree with me that after what we have heard today, when that laboratory has existed but one year, we may expect a great deal of it in future years.

With reference to the paper on carbonic acid gas, particularly its influence on the growth, inhibition and general effect on the organism, the older ones among you will remember that in the therapy of tuberculosis, we have had an era of gas treatment, about nineteen or twenty years ago, when I think a Frenchman named Bargeon introduced the sulphuretted hydrogen method of treatment by the rectum. That method fell into bad odor, possibly entirely irrespective of the odor of the gas, but for some reason unknown to me.

But none of you probably heard what happened to me some twenty years ago. I had a call from a gentleman from either West Virginia or Virginia, I've forgotten which, who seriously proposed to establish a sanatorium in one of the caves of either of those two states where there was a large proportion of carbonic acid gas escaping after the precipitation of carbonate of lime in the form of stalagmites and stalactites. He either wanted to build the sanatorium in the caves, or very near them, so that the patients could go down and live in an atmosphere of carbonic acid gas as a means of treatment. Whether he had the intuition of a "wiseacre," and whether possibly Dr. Corper and his co-workers are going to develop a system suggested years ago, remains to be seen.

Dr. Paul A. Lewis, Philadelphia, Pa.: It seems to me that Dr. Corper's method of determining the actual gas tension and tissues, on the possibilities of growth of the tubercle bacillus, under somewhat simplified conditions, but technically at least within the body, is very ingenious; and the whole idea, that the more intimate study of the gas is apparently simple, and that substances such as carbon dioxide may have an effect on the progress of the tubercle bacilli to grow in the face of conditions, is very stimulating to all of us.

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THE SIGNIFICANCE OF ALLERGY IN TUBERCULOSIS*

By Allen K. Krause, M.D.

Baltimore

A discussion of as complex a subject as that of allergy in tuberculosis, within the time allotted me, must of necessity be rather summary and synoptic, and suffer from the shortcomings of this manner of presentation. Asseveration, perhaps, will only too often take the place of that demonstration which the manifestations of a yet obscure phenomenon require. For these reasons I hesitate to take up your time with the following recital. Nevertheless, ten years of experimentation have brought me to the point where I think it desirable to attempt to correlate many diverse phases of our subject, and show how through all of them there runs, perhaps, the single thread of allergy. Throughout the century that separates Bayle and Laennec from us there has been a succession of swings of the pendulum between the two conceptual poles of unity and multiplicity of phthisis. The discovery of the tubercle bacillus ended abruptly and forever the perfervid arguments of the multiplicity adherents. To-day everyone acknowledges the etiological unity of tuberculosis. But the surface effects of this etiological unity are as diverse as they have ever been; and, being so, they have made for a Babel of ideas as to their causes. I am inclined to believe that a comprehension of allergy will resolve this confusion of concepts into fewer and simpler terms.

THE ESSENTIAL OR NATIVE REACTION OF TISSUES TO TUBERCLE BACILLI

One cannot comprehend the significance of allergy in tuberculosis without at the same time having a clear-cut conception of what we may call the essential or native tissue reaction to tubercle bacilli, that is, tissue reaction to a first introduction of bacilli.

Prominent features of this response to first infection are (1) extreme sluggishness of reaction, (2) lack of inflammatory phenomena, (3) predominance of proliferative phenomena, with the consequent formation of nodule (tubercle), and (4) total absence of intoxication.

In a normal animal the focalization of even large numbers of tubercle bacilli at a point will fail to bring about grossly visible tissue alteration before the end of the first week: the average time of noticeably palpable

* From the Kenneth Dows Tuberculosis Research Fund, of the Medical Clinic of the Johns Hopkins Hospital and University.
Read by title.

response to ordinary experimental infections is from ten to twenty days. There is never in any case a truly inflammatory *immediate* reaction. The microscope reveals the slow development of lesion through and by reason of proliferation and increase of cells of the fixed tissue type (probably of vascular and lymphatic endothelial origin) — the so-called epithelioid cells. If the numbers of bacilli are very small, not a leucocyte may be seen. If the dosage is very large, there is an immediate outpouring of polymorphonuclear leucocytes which very rapidly disappears, when proliferation is seen to be going on in an orderly way; and this leucocytic reaction is never noticeable to the naked eye as a complex of redness and swelling — two cardinal signs of inflammation.

At the same time, there is no noticeable early constitutional response to first infection with tubercle bacilli. No matter how large the dose and no matter how inoculated, the first bacilli will never render an animal ill — unless, perhaps, a suspension were so heavy that in a mechanical way it brought about physiological disturbance. This I have never observed.

DEFINITION OF ALLERGY

But the series of events is quite different following reinfection.

Then — that is, after inoculation of an already tuberculous animal — both local and constitutional changes occur with great promptness and celerity. Under these conditions, animals exhibit allergy, that is, a reacting capacity which is changed or different from the native or essential response. Allergy is characterized and is recognized by (1) extreme rapidity of exhibition and development of tissue change at points where bacilli focalize, (2) predominantly, almost exclusively, inflammatory character of immediate response, (3) accelerated appearance and abortive progression of proliferation, and (4) rapid intoxication of the animal.

The present essay purposes to deal only with allergy as it relates to changes of *tissue* reaction, except as it may be necessary to discuss other phases of hypersensitiveness, such as that recognized by the occurrence of anaphylactic shock, when it comes to take up the matter of intoxication. Unless a contrary conception is definitely mentioned or the present limitation of definition is expressly qualified, allergy will always mean changed tissue reaction in the sense outlined above.

THE NATURE AND CHARACTERISTICS OF ALLERGY

1. Conditions necessary for its development and recognition. No dissociated substance of the tubercle bacillus has ever to a certainty brought about the allergic state. *Only tubercle bacilli — living or dead — have produced it.* Allergy due to dead bacilli is inconstant, feeble and transitory; that set up by living bacilli in a previously normal animal is remarkably invariable, marked and durable. In other words, *there is no allergy without tubercle.*

The allergic state, as before mentioned, is recognized by a rapid inflam-

matory reaction to the proper antigen. The reaction is elicited by living or dead tubercle bacilli or any dissociated product of these which contains protein (tuberculin). Thus, *while dissociated tuberculoprotein cannot bring about the allergic state, the true allergic reaction is apparently set in motion only by tuberculoprotein whether dissociated or contained in intact bacilli.* Therefore, until the contrary is proved, we would class allergy among bioreactions to protein.

2. The time relations of allergy. Dependent upon the virulence and dosage of the infecting microörganism, the first manifestations of allergy are elicited in an animal (guinea pig) at from six to twenty-five days after first infection, that is, at about the time of the first development of tubercle. The same time relations apparently hold in man (Hamburger, Hess). All experimentation indicates that it persists as long as specific tubercle remains in the body.

3. The variations and fluctuations of allergy. The capacity for allergy varies tremendously if we contrast the several animal species. Man is apparently the most sensitive animal: at least, he will react to the smallest doses of tuberculin — and presumptively, therefore, to the smallest numbers of tubercle bacilli. The sheep is highly allergic (Roemer). The guinea pig is much less sensitive than man or the sheep; for instance, no guinea pig, however tuberculous, will react to tuberculin applied through a scratch or scarification à la Pirquet; it will, however, react very constantly and vigorously to the *intradermic* application of the proper amount of tuberculin, an amount which is far in excess of that capable of eliciting the response in man. The rabbit is the least sensitive of all animals commonly experimented with: skin reactions are inconstant and comparatively feeble.

Experiment will show that allergy follows a quantitative and qualitative curve, that is, one of degree and intensity, which is roughly parallel with the development and progression or retrogression of infection. Studies, published by me five years ago, pointed out very sharply that allergy in guinea pigs inoculated with virulent human bacilli began at about ten to fifteen days after infection and increased progressively with the development and extension of the infection until the animals became moribund. The phenomenon, however, proceeded differently in guinea pigs that had been inoculated with comparatively avirulent human bacilli, which, while setting up tubercle, did not kill the animals. The latter were frequently tested and studied over a period of almost two years. The allergic course in them was about as follows: Allergy first appeared a few days later than in the virulently infected animals; autopsy showed that tubercle also developed more slowly. With the development and progression of tubercle, allergy increased to a marked and constant degree but never reached as high a point as in the virulently infected animals. After about forty days it attained a "plateau" which it held for a long time — for months. Then, as physical examination and autopsy revealed that tubercle was being arrested and was retrogressing, allergy began to diminish. It continued to fall until it became very slight. In no case,

however, did it disappear, that is, return to the base line represented by the native or original capacity of the animals to react. Autopsy and microscopic examination of tissues of these slightly-reacting animals, 697 days after infection, showed only very sclerotic and very well invested tubercle in regionary lymph nodes.

It was also found that reinfection performed 669 days after first infection markedly increased a diminishing power to react. We are therefore led to believe that in life, and under the influence of tubercle, the allergic state is continually fluctuating with the amount and pathological condition (competence of investment, opportunities of focal absorption, etc.) of tubercle, that it is increased for longer or shorter intervals by extension or metastasis of infection, or by reinfection, and that it is being diminished as the sum total of sclerosis keeps ahead of the sum total of degeneration or fresh extension, so long as the physiological activities of the animal remain the same. Our methods for estimating quantitative and qualitative relations are so crude that finer variations of allergy in the human being are usually impossible of detection; but that the allergic state is continually fluctuating in the tuberculous individual there can be no doubt.

At this place, also, I would merely refer to the well-known diminution of allergy, which is brought about by intercurrent disease, pregnancy, perhaps fatigue, etc., in tuberculous animals. It is important to remember also, that during the height of and for a short time after a general tuberculin reaction, allergy may diminish to the vanishing point. It may similarly diminish during certain phases of acute tuberculosis.

4. The tissues affected by the allergic state. Allergy is best known through the easily obtainable reactions of the skin and superficial mucous membranes. But all studies made thus far would lead us to postulate that all tissues of the body of a tuberculous animal are allergic (Nichols on the lung, Kindberg on the kidney, Paterson on the pleura, Soper on the liver, etc.). Whether at a given time all tissues are allergic to the same extent is an important question that has not been investigated — probably because of the very great sources of error in any experimental technique which would approach this problem.

5. Tuberculous foci are highly allergic. While the comparative allergic capacity of uninvolved tissues is a problem awaiting solution, there is no question of the much greater reacting quality of tuberculous foci as compared with non-tuberculous tissues of the same animal. The well known inflammatory focal reaction following a subcutaneous injection of tuberculin is nothing else than an allergic tissue reaction. The amount of tuberculin which is "fixed" by foci, under these conditions, must often be extraordinarily minute; the results are frequently intense, even violent, as may be learned from the animal of experiment. A very small amount of tuberculin, superficially applied, will inflame a tuberculous ulcer (Sternberg); or, allowed to drain by the skin lymphatics to a patch of lupus, may induce a violent reaction in the latter. In general, it may be said that the competence of investment of a given tubercle will govern

its capacity to react; old, sclerotic tubercles are much harder to react than are young or softening ones.

6. Trauma not necessary to elicit allergy. Because the skin or mucous membrane must be punctured to bring about the reaction, it may be thought that is will occur only when a tissue is wounded. But focal reactions, and the inflammations following the introduction of reinfecting bacilli by way of the blood, at points where these focalize in internal organs, teach us that the reaction may be brought about without the application of trauma; unless, indeed, in the latter event the focalization (embolization) of bacilli, highly resistant to outside influences, may be conceived as a traumatizing act.

7. Variations of intensity of the allergic reaction. The reaction may run the entire gamut of inflammatory intensity. It may be anything from a very faint and transitory redness and swelling to the most violent necrosis, with hemorrhage and rapid sloughing (Koch phenomenon). We are very likely correct in assuming also, that, below the limits of visibility, reactions may occur which involve the pouring out of only a few cells. Sometimes the reaction may be delayed; instead of first appearing from six or twelve or twenty-four hours after the application of tuberculoprotein or bacilli, it only becomes manifest from two to four days thereafter. Not infrequently the reacting area presents a centre which is pallid or ischaemic, while the periphery is red.

8. Factors which influence the intensity of the reaction. The most prominent analyzable factors are degree of allergy at any time plus the dosage of antigen (tuberculoprotein, tubercle bacilli). High allergy with large amounts of antigen make for prompt and vigorous reaction. High allergy with very few reinfecting bacilli or low allergy with large numbers of bacilli may produce only moderate or slight reactions. There is one factor, which has never been studied experimentally, but which undoubtedly has a definite influence on the intensity of the reaction of the skin. This is the amount and character of skin pigmentation; the pigment-free skin, for instance, of albino guinea pigs reacts much more vigorously than colored skins, from light fawn to black. Another factor which may presumably affect the capacity for allergy is the constitutional one of heredity; there can be little doubt that individuals, families and even race stocks, vary greatly in their relative, basic capacities to react, whether exudatively or proliferatively, to irritation. Since the presence of pigment, or the tissues' ability to form pigment, is an inherited factor, it may be assimilated with whatever other qualities underlie the hereditary factor in allergy. Since, too, we have no satisfactory experimental data on the influence of pigmentation or inheritance on allergy, neither of these factors will be discussed in this paper.

9. Reasons for believing that allergy and anaphylactic hypersensitiveness are not identical phenomena or phenomena governed by the same mechanisms. In most works on the subject of hypersensitiveness, tissue allergy and anaphylactic hypersensitiveness have been greatly confused or the terms have been used interchangeably. Both are quite likely con-

ditions of hypersensitiveness to protein; but the evidence that in tuberculosis they do not proceed from the same causes and that they do not possess identical mechanisms may be summed up as follows:

a. Anaphylactic hypersensitiveness is easily and regularly established in an animal by the parenteric injection of dissociated tuberculoprotein; it is quite certain that allergy has as yet not been thus attained.

b. Anaphylactic hypersensitiveness to tuberculoprotein is very uniformly transmitted by inheritance through the female animal; no one has ever been able to record a similar transmission of tissue allergy.

c. Allergy to tuberculoprotein always comes into being through the establishment of focal tubercle, AND IN THIS WAY ONLY; *anapylactic hypersensitiveness may or may not exist after the development of tubercle.*

d. Unquestionably demonstrable immunity to tuberculous infection never accompanies anaphylactic hypersensitiveness in the nontuberculous animal, however high the hypersensitiveness may be; it always attends tissue allergy, no matter how low this is.

10. Reason for believing that allergy and anaphylactic hypersensitiveness are basically similar. There is only one reason for such a conception. This proceeds from the fact that in the proper animals anaphylactic shock and the allergic reaction are released by the toxic injection of protein, — of one and the same protein.

THE SIGNIFICANCE OF ALLERGY IN IMMUNITY TO TUBERCULOSIS

Resistance to tuberculous infection and extension is, without doubt, made up of several — perhaps many — elements; not the least of which is included in the checks and obstacles to bacillary development and spread which mechanical influences bring into play; such, for instance, as the internment and investment which the architecture of real tubercular structures brings about. At this place, however, we would confine our discussion of resistance to that phase of it which we comprehend as specific immunity.

Almost numberless variants and derivatives of tubercle bacilli have been experimentally employed to attain active immunization against tuberculous infection; but observers are agreed that only one procedure is uniformly successful. This consists in preliminary infection with living tubercle bacilli. In other words, we will not admit to-day that specific immunity ever exists without tubercle in the host.

The "laws," if we may so call them, of specific immunity to tuberculosis, as worked out by many experimenters, during the last three decades, may be summarized as follows:

1. There is no specific immunity without preëxisting tubercle.
2. Immunity first appears with the palpable development of the focus.
3. It diminishes with the healing of the focus.
4. It disappears with the enucleation of the focus.
5. The degree of immunity varies directly with the virulence of the

immunizing microörganism; or, otherwise expressed, with the amount of tubercle and activity of lesion in the host.

It is of the utmost significance that the circumstances of allergy exactly parallel those of specific immunity. It is especially significant that, in this respect, allergy stands alone among all known immunological reactions. Precipitins, agglutinins, aggressins, opsonins, complement fixing bodies, anaphylactic hypersensitiveness, etc., are all obtainable without the intervention of tubercle bacilli (and, therefore, tubercle), and by means of dissociated products. Again, all of these may be lacking in animals, which are demonstrably immune. But as regards allergy, we find that

1. It is never observed unless tubercle is present.
2. It appears coincidently with the establishment of lesion.
3. It diminishes as lesion heals.
4. It varies directly with the intensity of the disease, which is in turn dependent, not wholly, but in large measure, on the virulence of the bacilli concerned.

This close and direct parallelism of immunity and allergy at once suggests that immunity is a function of allergy. As to the character of the mechanism, set in motion by the allergic reaction, by which immunity is accomplished, opinions may legitimately differ, inasmuch as the underlying forces of allergy are as yet thoroughly obscure.

Nevertheless, the original idea, that reinfection was prevented or made much weaker, because of the casting out of bacilli involved in the slough, may be abandoned; for it can easily be demonstrated that reinfection does not "take," even though sloughing or ulceration do not occur. Another view (held particularly by Rist and by Paterson), that immunity occurs because at the local sites of allergic inflammatory reaction lysins are released and brought into play, has the merit of a reasonable interpretation and of squaring with our present conceptions of the disposition which the tissues make of living foreign particles. Yet undoubted scientific demonstration of these hypothetical lysins in tuberculosis has thus far been very incomplete and unsatisfactory.

Personally, I cannot conceive of either the anaphylactic or allergic reaction going on without the intermediation of some kind of lytic phenomena; yet I am disinclined to accept the lysin hypothesis without reserve, and at its full face value, until I can exhibit the lysins in a way that is free from criticism, and this I have so far failed to do.

There is yet another at least plausible point of view which one may take of the allergic mechanism as it concerns immunity. It involves a mechanical explanation of end effects while it does not seek out the fundamental springs of allergy; and until its fallacy has been pointed out, I am inclined to entertain it.

In a normal, nonallergic animal, because of the sluggishness of the native tissue reaction, tubercle bacilli are able to spread over a comparatively large area and to remote parts of the body with remarkable facility. I have shown, experimentally, how in the guinea pig, after subcutaneous

infection, the bacilli may reach the centre of drainage for foreign particles — the tracheobronchial nodes — in four days or less. This means that, given sufficiently large initial dosage, bacilli in variable numbers can be carried throughout the body and form many loci of infection (though not necessarily of quickly apparent lesion) before competent tubercular reactions are interposed to bar their transit and progress.

In the allergic animal, on the other hand, reinfecting bacilli, wherever they come to rest in the tissues, are met by an immediate tissue reaction — inflammation — which tends to bar their progress and limit their activities. In other words, they are arrested *in situ;* while in the normal animal they are given opportunity to multiply and spread before the latent reacting capacities of the tissues are sufficiently aroused to deal with them effectively.

I had always thought that the new capacity for inflammation represented the entire transformation which tissues underwent in allergy, until recently, when more exact and detailed studies unerringly showed me that in the allergic animal proliferation, resulting in the formation of tubercular structures, was much more accelerated than after first infection. If we view the anatomic response of tubercle as a defensive tissue reaction to foreign bodies, as we have every right to do, then we find that the proliferative or tubercular or defensive tissue reaction is likewise much more active in the allergic animal.

For him who is attracted by the philosophy of science — if you will allow this association of antithetical concepts — it is a remarkably fascinating exercise to experiment upon several series of animals, to inoculate some with what we call nonpathogenic acid-fast bacilli and some with virulent tubercle bacilli, and then observe what happens and cogitate its meaning.

As all of you know, there is a large class of what we call nonpathogenic acid-fast bacilli, which are so designated because upon inoculation into animals they bring about no progressive disease. But they do produce lesion, when applied in sufficiently large dosage. And all-important for our present discussion is the way in which this lesion develops,— the way in which the tissues meet the first invasion of nonpathogenic acid-fast bacilli.

What happens is that within a very short time — from one to three days — lesion of a semi-tubercular nature is quite apparent and palpable. The native tissue reaction to these microörganisms is much more acute and has much more of an inflammatory nature than that to tubercle bacilli. And, after ten days or two to three weeks, all lesion has disappeared. The whole series of events following a *first* infection with nonpathogenic acid-fasts resembles greatly that which is brought about in the *allergic* tuberculous animal, which receives a second infection of tubercle bacilli.

Here, then, we see that to those germs, which the final issue teaches us to call nonvirulent, the reaction, the native tissue reaction, is rapid, acute and vigorous, and pathological effects begin by being comparatively

florid, soon come to a standstill and rapidly disappear; while to those germs (tubercle baciili) which experience compels us to call virulent, the native tissue reaction is indolent and greatly delayed, — acuteness and vigor begin only after about two weeks, when, because of the first infection, the tissues have been "trained" to allergy.

What does all this mean? What may it mean? Shall we start with the concept that native (and perhaps acquired) immunity does *not* mean a failure to react or an indolence of reaction? Shall we conceive that natively immune animals are those which react rapidly and vigorously to living parasites, while natively nonimmune animals are those which react slowly or not at all to given microörganisms? Time forbids my going further at this place than merely to raise the question. In view of current ideas on immunity and its effects, I would reserve further discussion of it under the title of "A Paradoxical Concept of Immunity." It does, however, bring us back to other well grounded ideas, based on other data, such as that the clinical phases of infection are for the most part expressions of immunity; that the most immune, that is, the best reacting animal is usually the sickest animal; and especially that failure or absence of resistance in general must not be interpreted in terms of symtomatic vigor and physical disability — an idea which may be combatted by many arguments drawn from experimental and pathological observations in tuberculosis.

It would be a pleasure to pursue the discussion of the immunological side of allergy further. But other phases of allergy demand some attention, and I must hurry along. I should like to take up the matter of anergy, which for some time has been under investigation in my laboratory. This again cannot be discussed here. For two years, also, Dr. Willis and I have been working on the spread of bacilli in allergic animals; and we hope at some future meeting of this Association to present more exact data on the subject.

THE SIGNIFICANCE OF ALLERGY IN THE PATHOLOGY OF TUBERCULOSIS

To the student, allergy furnishes the key which bids fair to unlock the outstanding riddle of tuberculosis — the mystery that so baffled the early observers and so long delayed a more exact appreciation of the disease; that led Virchow into the quagmire of the duality dogma and pushed Niemeyer to the absurd but logical conclusions of Virchovian dogma. This is the mystery of the enormously multiplex and multicolored pathological background of tuberculosis, — a background which runs the entire scale from almost pure tumor formation to purest inflammation, with all combinations of these elements, and punctuated with effusions of every type, the deposition of salts and the irregular formation of cartilage and even bone.

It is this phase of tuberculosis also, this variegated anatomic response, which has led many to call upon handy *dei ex machina* for explanation.

It was — so it was often maintained — the virulence of the bacillus which determined the pathological condition; and almost innumerable virulences were of necessity postulated to explain how almost innumerable anatomic conditions might be brought about. Yet the net result of many studies on virulence has been to emphasize all the more a fixity of bacillary type and potentialities, more marked perhaps than for any other known bacterium. Not a few, again, have attempted to explain pathological differences on the basis of accompanying or secondary microörganisms (mixed infection). But only a limited experience with controlled animals of experiment will suffice to show one that tubercle bacilli alone can and do produce every describable tuberculous lesion.

Experiment will also clearly disclose this: That first infection during its first few days practically always proceeds in the uniform manner, which I have described, no matter what the dosage; but that after animals have been made allergic, pathological response to reinfection can be an enormously variable affair, — and in this connection it must be remembered that shortly after first infection has occurred the host becomes allergic because of it, and extension of infection within the host will take place into allergic soil.

We may use animals of various degrees of allergy, depending on original dosage and time since infection, and these we may look upon as variables. As the constant we may use for reinfection the same suspension of the same culture of tubercle bacilli, applied into the same skin areas at the same time. The response which we may observe will be extremely variable, depending upon the degree of allergy in any particular animal and the variations of bacillary dosage. The reaction, as mentioned earlier, can be made to be anything from mild inflammation to extensive and violent necrosis, followed by sloughing.

Is the peculiar necrosis, the coagulation necrosis of Weigert, the caseation, of tuberculosis an allergic effect? It may occur with extreme rapidity, as now and again happens when the contents of cavities are discharged into midlung; when, in other words, large numbers of bacilli are brought to bear on highly allergic soil. Or it may develop slowly, in small foci, where a few bacilli are disintegrating slowly, and a gradual sensitization and intoxication are taking place *in situ*. In this connection, too, we may recall the Arthus phenomenon, the production of necrosis by a second injection of horse serum into the same area of the skin of a rabbit where serum had been previously injected. Although this particular question has long engaged my interest and attention, I shall not attempt to answer it. In passing, however, it may be added that the idea that caseation, like anaemic infarct, is a result of tissue ischaemia, occurring in a thrombosing infection and in avascular foci, is very vulnerable.

I think we may safely say that every acute pathological tuberculous process is the result of reinfection in allergic soil. It is plain that serous membrane disease — tuberculous pleurisy and peritonitis with and without effusion, tuberculous hydrops of joints, and meningitis in human

beings — must be reinfection phases, in the sense that they represent extensions or metastases from foci elsewhere in the body. Their acuteness and severity will depend on degree of allergy, and size and concentration of dosage at the time of reinfection. Acute tuberculous pneumonia is most frequently met with lower down than the apex of the lung, and is usually brought about by spread of infection from older pulmonary foci. Miliary tuberculosis, another acute pathological type, is always the result of reinfection from older foci. In miliary disease we find many small and discrete areas which show acute inflammation in the very early stages; here, at most loci of reinfection, very small numbers of bacilli exert their effects on allergic tissues; while many areas of acute tuberculous pneumonia, resulting from aspiration of material from older foci, are large and massive, inasmuch as large numbers of bacilli are brought to bear within a comparatively small compass. In chronic apical tuberculosis of ordinary type, that is, chronic infiltrative tuberculosis, it is likely that tubercle spreads with extreme slowness and by short excursions of bacilli by way of lymphatics, as well as by growth of tubercle by apposition. Bacilli which set up fresh foci are relatively few at any one time and the process develops with only slight pneumonic phenomena, which are not appreciable to ordinary physical examination and are too insignificant to be disclosed clinically.

Tendeloo discusses at great length the importance of what he designates the collateral inflammation of tuberculous processes. He points out how acutely tissues may be struck with inflammation where tubercle bacilli localize and throughout a wide area, which extends beyond the point of bacillary focalization; how the peripheral inflammation may rapidly subside, leaving only the "nucleus" of infection — the bacilli-containing centre — which may then go on to caseation or fibrosis or both. Tendeloo's conception of this pathological type of infection is that it is determined by dosage and virulence of bacilli; and he nowhere mentions tissue allergy as being a factor in it. Yet it is exactly comparable with what we notice when we experimentally reinfect the skin of a tuberculous or allergic animal, and with what we fail to observe when we infect the skin of a normal nonallergic animal; and there is no doubt that Tendeloo's collateral inflammation is an expression of allergy. We would repeat, therefore, that *the acute pathological phases of tuberculosis always mean reinfection;* and again beg you to remember that from about ten days on, after a first infection, an animal becomes allergic by reason of this first infection and is then capable of exhibiting acute lesions, provided reinfection to other parts of the body occurs. We would also emphasize that in allergic animals reinfection may be caused by so few bacilli that the allergic reaction may be so mild as to be hardly noticeable, or reinfection may occur after long periods of quiescence, as undoubtedly happens frequently in human beings, when allergy is comparatively low.

THE SIGNIFICANCE OF ALLERGY IN CLINICAL TUBERCULOSIS

The foregoing consideration of allergy in the pathology of tuberculosis makes it almost superfluous to discuss clinical tuberculosis from the point of view of allergy; for the clinical features of disease are for the most part but expressions and reflections of underlying pathological changes. We may go one step further and suggest that *acute clinical tuberculosis is always the expression of reinfection.* If a man falls acutely ill with tuberculosis it means that there has been rapid fresh extension or metastasis of infection from preëxisting foci, whether these latter were or were not known to exist. I have yet to see an animal become acutely ill, following a first inoculation of tubercle bacilli — even of excessive doses of a milky suspension introduced by vein. I have yet to observe a tuberculous animal *not* show acute illness, following the introduction of comparatively small numbers of reinfecting bacilli.

This brings us at once to the matter of intoxication, which makes up so large a part of the clinical picture of tuberculosis and which expresses itself in so varied a way. The subject is so involved and intricate that I hesitate to enter upon it here. Nevertheless, its importance is such that for the sake of completeness I shall take up a few phases of it.

The question of intoxication in tuberculosis must revolve around the primary question of what causes intoxication in tuberculosis. No one has ever satisfactorily shown that any constituent or product of tubercle bacilli acts as an essential poison, in the sense that it will specifically affect the well being of normal animals. Yet excessively small doses of derivatives of tubercle bacilli or small numbers of intact tubercle bacilli will set up symptoms of violent illness in tuberculous animals.

I think it may safely be said that no tuberculous animal ever exhibits constitutional symptoms unless at the same time focal activity or an increase of customary focal activity is taking place. A symptomatic patient may be made symptomless by keeping him at rest or in a state of comparative physiological inactivity; by subjecting him to comparative strain we can very easily again elicit symptoms. Or an asymptomatic patient may be kept at rest and given an overdose of tuberculin, when, within a few hours, he will begin to feel ill. There may be differences of degree between the symptoms of the actively tuberculous patient and those of the patient suffering a constitutional tuberculin reaction, but there is assuredly no difference in kind of symptoms. In both instances we meet with the familiar evidences of elevated temperature and pulse, asthenia and aching, nervous irritability, distaste for food, etc. In both cases the patients are ill because they have absorbed an excess of something from the foci of disease, and they have absorbed focal material more readily than usual because either focal activity has for the time being increased or conditions around an unchanged focus have been made more favorable for absorption of focal material. In the first case

cited above, we stir up the focus by overexercising the patient; in the second case, by tuberculin.

Avascular themselves, tuberculous areas are always more or less completely walled off structures. In some, the investment is remarkably competent; in others, very tenuous. The exchange of materials between foci and tissues surrounding them will be largely determined by the perviousness or imperviousness of the investing envelopes and by the circulatory activity of the surrounding tissues. This circulatory activity is a continually variable affair; bodily and organic rest tend to diminish it; activity to increase it. Anything which increases circulatory activity of the body or of an organ of the body — unusual work or exercise, intercurrent diseases with fever (especially respiratory diseases), increased respiratory activity, the second stage of labor, etc.— will bring about those conditions, which facilitate absorption of materials from foci in parts of the body which are thus influenced.

Tuberculin in excess acts in a similar manner on the focus. Because of the allergy of tuberculous animals it produces focal reactions. Reinfecting bacilli likewise cause focal reactions. These focal reactions express themselves by inflammations of varying degree of the tissues immediately in contact with the foci; and during the early stages of such inflammations the very circulatory conditions are established which enhance the absorption of focal materials.

Because of experiments on intoxication, which I reported five years ago and as partially explaining intoxication, I still incline to the view that any tissue products, normal or abnormal, when thrown into the circulation in excess in unit time, will intoxicate an animal. Deep-seated chemical changes (protein cleavage, ferment action, etc.) are very likely going on in tuberculous foci all the time. Under ordinary conditions, if foci are well invested and comparatively impermeable, not enough is absorbed from foci to make the animal ill. But under conditions such as outlined above, much larger and intoxicating amounts gain the circulation in a short time. It is also quite likely that the local inflammation, induced by allergy, aids in breaking down focal materials and thus rendering them toxic.

A concept such as I have outlined would therefore interpret allergy as bringing about intoxication in an indirect manner. Because they are allergic, tuberculous foci react with inflammation to tubercle bacilli or the derivatives of these; the resulting inflammation then contributes to the dissolution of focal products and facilitates their absorption to the point which will bring on intoxication. Yet the intoxicating substances may be looked upon as being more or less nonspecific in character.

In the vast majority of cases of human tuberculosis, reinfection, extension, metatasis, proceeds with so few bacilli concerned that no appreciably acute explosion occurs and relatively slight new lesion results. Such instances, the commonest events in human tuberculosis, do not resemble what we usually bring about in experimentation. But when large amounts of material are let loose suddenly over a single area or scattered broad-

cast, then we begin to approximate what we observe in our laboratory animals following the ordinary methods of study. It is such events that furnish us our clinical cases of acute tuberculous pneumonia and generalized miliary tuberculosis.

In both these types of clinical disease, previously healthy men may fall ill abruptly; sometimes in miliary tuberculosis, even with a rigor. Intoxication of varying degree dominates the entire early picture; at first localizing signs are few; as a rule, entirely absent. The patients undergo an early clinical course which in essentials does not appear materially different from that observed in tuberculous guinea pigs or rabbits reinfected with moderate doses of living tubercle bacilli intravenously. Such animals within a very short time — four or five hours — become very ill, with fever, dyspnoea, thorough failure of muscle tone, and their general appearance is one of extreme misery. Many may die from twelve hours to two days after reinfection.

If we section the dead animals, we get the clue as to what has been happening; indeed, where small tubercle exists the whole organ may show acute inflammation. In other words, foci have been reacted by the reinfecting bacilli (just as they would be reacted by tuberculin). But there may, in addition, be many other acute lesions throughout the body: the lungs and other organs may show many small, sometimes confluent, areas of acute inflammation, sometimes even with hemorrhage, where bacilli in sufficient amount have embolized.

In such animals it is likely that intoxication in part was caused by the absorption of substances from foci, under the influence of the inflammation of acute reaction brought about by reinfecting bacilli. But one also gets the impression that to this is added whatever intoxication would be brought about by the absorption of materials from the numerous areas of newly exuded elements which are found where the reinfecting bacilli have embolized.

I cannot hold the view that the general tuberculin reaction or tuberculous intoxication in general is an anaphylactic manifestation. We know for a certainty that although symptoms of anaphylaxis can be easily and uniformly elicited in properly hypersensitive animals (guinea pigs) by the *subcutaneous or intraperitoneal* injection of horse serum or egg white or other substances, such is not the case in tuberculoprotein hypersensitiveness. It is possible to render non-tuberculous guinea pigs hypersensitive to tuberculoprotein, so that a toxic injection, made later by way of the *optic foramen* or by a *vein*, will regularly cause anaphylactic shock; but only in very rare instances can we arouse symptoms in such guinea pigs if we make our toxic injections subcutaneously or intraperitoneally. I have produced symptoms in this way but only a very few times and then enormous toxic doses were used. If, on the other hand, a guinea pig is tuberculous, then a relatively small subcutaneous dose of tuberculin will bring about the intoxication of the general reaction. Stated briefly, *a general reaction occurs only through the intermediation of a focal reaction and without a focal reaction there will be no general reaction.* For a

general reaction to occur there must be produced, by reason of an immediately antecedent and coincidently developing focal reaction, either new absorbable, toxic substances in the focus or enhanced conditions for the absorption of ordinary focal substances. In another place, as mentioned, I have published the experimental evidence which leads me to believe that the latter is the case.

THE SIGNIFICANCE OF ALLERGY IN THE THERAPY OF TUBERCULOSIS

This, for most practitioners of tuberculosis, the most practical phase of our inquiry, is again so involved, and my time is so limited, that I will not attempt to go into it here. I would refer those interested in the subject to two essays, published by me a year ago in the JOURNAL OF THE OUTDOOR LIFE, on The Nature of Tuberculin, and The Action of Tuberculin. Yet I would take the opportunity to remark that the specific (tuberculin) therapy of tuberculosis has its place and its uses, that no one can appreciate its significance without at the same time having a knowledge of the nature and effects of allergy, and that, as our information concerning allergy in tuberculosis grows, our specific therapy of the disease will be translated from the empirical basis it now rests on to a more solid, rational and scientific foundation.

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CHEMICAL PROBLEMS IN THE BACTERIOLOGY OF THE TUBERCLE BACILLUS*

By Esmond R. Long, Ph.D.

Chicago

An able investigator, Dr. Kendall, once defined bacteria, or partially defined them, as chemical reagents. The characterization is by no means far-fetched, as we see when we stop to consider the multitude of reactions carried out sharply and completely by different bacteria, reactions duplicated exactly by ordinary analytical methods with common chemical reagents in the laboratory. Consider the phenomenon of deaminization. If I add to the substance alanine, which has an amino or NH_2 group in its structure, a small amount of nitrous acid, and warm the mixture, nitrogen is split off and a hydroxyl group substituted. The process is deaminization. The same end result may be secured through the action of a great variety of bacteria. Just how they accomplish the result we do not know. We speak somewhat vaguely of enzyme action with notions far from clear on intermediate steps; yet the end result we know with certainty.

Take for another example the production of histamine from histidine. The latter is an amino acid and like all amino acids contains a carboxyl or COOH group. Under the action of some bacteria, notably certain strains of B. coli, CO_2 is split off and imid-azol-ethylamine produced, histamine, one of the most potent poisons known. Some of the same product may be produced from histidine in the laboratory by the simple process of dry distillation, CO_2 being split off at the high temperature.

Or consider the action of common yeast on dextrose. Through the enzyme action of the yeast we have produced — if we agree with Neuberg — pyruvic acid and atomic hydrogen. From the former carbon dioxide is evolved with the production of acetaldehyde, which in turn is reduced by the aforesaid hydrogen with the production of ethyl alcohol — no mean accomplishment for any chemist these days.

Now much as I respect the analytical powers of bacteria I am more profoundly impressed by their aptitude for the reverse process, synthesis, their power of building up complex structure from the simplest of materials. I think of them as chemical machines especially adapted for synthesis on a grand scale. Of course this ability is common to all forms of life from a baby down, but the process is followed more readily in the simple unicellular forms. The characterization as chemical machinery

* Work being done under grant of the Committee on Medical Research of the National Tuberculosis Association.

for synthesis holds for parasites and saprophytes, the difference in the two being entirely in their reaction to environment. If I may attempt a definition too I will say that a parasite is a mixture of proteins, capable of synthesizing more protein within the tissues of a living being, protein being the substance, according to the best information available at the present time, characteristic of life, and the rapid construction of that protein by small masses of the original protein constitutes virulence, chemically considered.

Unfortunately we are unable to catch any of the midstages in this remarkable process, although we can detect a good many in the reverse process, that of tearing a protein molecule down. We are able to set up a chemically well-defined meal before a given bacterium and determine with a high degree of accuracy what it takes and what it leaves, and then we are able to analyze the product and say — with far less accuracy — what it has done with what we provided. But how it put the structure together from the simple substances we gave it, remains a puzzle.

I have been interested for some time in the utilization of certain food stuffs by the tubercle bacillus. Here is an organism that takes *us* for its food material and builds up its peculiar proteins out of the disintegration products of ours. I shall never forget how deeply impressed I was, when I was assisting in the work at the Reception Hospital at Saranac Lake, at the phenomenon of a twenty-year-old girl bringing up a quart of sputum a day, every one-twelfth oil immersion field of which contained hundreds and hundreds of living tubercle bacilli. There was synthesis and parasitism, and virulence.

Now what is this tubercle bacillus whose capacity for synthesis is so destructive to the human host? Chemically considered it is a mixture of proteins, nucleo-proteins, and perhaps lipo-proteins and glyco-proteins, in a cell which contains a high amount, as compared with other bacteria, of certain peculiar lipoids. Because of this characteristic high fat content and its relation to the phenomenon of acid-fastness, an enormous amount of work has been done on this phase of the chemistry of the organism, and, I think, in proportion to the time, effort, and money spent on it, with the least success. Not that much good work has not been done, or that good men have not attacked the problem. I simply mean that lipoids are physically of such consistency that most of them have never been separated sharply, and purified and identified. But I have high hopes in this direction. Dr. Levene, who has done such splendid work in this field recently, tells me that we may look forward to the elaboration, within a very few more years, of methods which will make the analysis of lipoid mixtures a fairly exact procedure. In the meantime we have, of course, acquired much valuable information, even if it is far from complete. We know that the waxy mixture contains a good deal of true fat, and a high proportion of an alcohol of high molecular weight, called "mykol" by Sakae Tamura, and that phosphatids are present in considerable amount. I want to know more about these last substances, the phosphatids. I believe the phosphorus problem has been highly neglected in

bacterial chemistry in general. Here is a field which must be carefully cultivated when the new methods arrive.

I should like to take a vote in this audience to see how many consider the tubercle bacillus of plant, how many of animal nature. I have had it in mind for some time to apply certain chemical tests to this organism, to gain information on this, perhaps academic, point. As you all know, the chemical distinction between plant and animal life is far from absolute; yet there are some lines on which broad generalizations on difference have been laid down. One of these respects the insoluble carbohydrates. In plants, the woody forms of life, we have such substances as cellulose, hemicelluloses and starch. In the lower forms of animal life, insects, crustaceans, etc., we have, in the hard parts, carbohydrates made up just as in plant life from polymerized small molecules, but with this difference — they contain nitrogen. In them, not glucose molecules as in starch, but glucosamine molecules, are piled up to make what is known as chitin. Now chitin has been described in several bacteria. Iwanoff was among the first to detect it, noting its presence in several forms, including the anthrax bacillus. As good a man as Ruppel, whose early article on the proteins of the tubercle bacillus is classic, suggests that chitin or a similar substance might be responsible for the acid-fastness of the organism. Helbing believed the same thing. The evidence was poor. But there is a problem to be worked out at any rate. Of course everything under the sun has been referred to as responsible for the phenomenon of acid-fastness, in almost total neglect, it seems to me, of the well known fact that an extremely finely powdered mass of tubercle bacilli, ground, let us say, in a ball mill, is non-acid-fast. Presumably such a mass contains the same chemical constituents as the unground bacilli. The phenomenon of colloidal dispersion of the different constituents has not been thoroughly taken into account. The problem should be attacked by the physical as well as the organic chemists.

The protein of the tubercle bacillus has been considered essentially nucleoprotein. I think more or less inaccuracy has been involved in the decision, although there is no question that a good deal is nucleoprotein. But the test for nucleoprotein has too often been the presence of phosphorus in a crude protein mixture having the solubility characteristics of known nucleoproteins. In this connection I may say that just the other day in my laboratory we found a substance in defatted tubercle bacilli which was rich in phosphorus, was soluble in water and alcohol, insoluble in toluene and acetone, which was organic and gave a mercury salt, but gave none of the protein reactions. I was looking at the time for alcohol soluble proteins, which at the present time, because of the work of Osborne, are attracting considerable attention.

Some months ago, instead of using phosphorus as the indicator for the amount of nucleic acid present, I used substances far more definitely characteristic of nucleic acid, namely, the purine bases, and from the amounts found calculated that the nucleic acid content of the bacillus was between 2.0 and 3.5 per cent. of the dry weight. This was smaller than I expected,

and led me to believe that a higher proportion than I had originally supposed was simple protein. Through the coöperation of that excellent chemist, Dr. Treat B. Johnson, I expect to have another check run on this, using not the purine bases this time but other substances also highly characteristic of nucleic acid, the pyrimidine bases. Further data on a point I mentioned a few moments ago may be furnished by this investigation. Curiously enough, as far as we know now, there are two distinct nucleic acids and just two, one of these being found in plant forms, like yeast and wheat, the other occurring in animal tissues, like pancreas or thymus gland, the chromosomes of animal nuclei in general presumably. They are a good deal alike. The structure is the same. Each is built upon phosphoric acid linked with two pyrimidines and two purines by carbohydrate bridges. The purines are the same, guanine and adenine, but the pyrimidines vary and the bridge is different. Both forms are said to contain the pyrimidine cytosine, but in the plant acid the other pyrimidine is apparently uracil, while in the animal form it is thymine. And the carbohydrate bridge is in the plant acid a pentose, and in the animal a hexose. Now I am going to have the nucleic acid of the bacillus more thoroughly investigated. Through the courtesy of Parke, Davis & Co., and Mulford & Co., and Dr. Dorset of Washington, I have collected about three kilograms of dry tubercle bacilli, which are to be analyzed for certain things. Dr. Levene has promised to get out the nucleic acid and determine if its sugar is a pentose or a hexose, in series with his other valuable reports on nucleic acids. Dr. Johnson will supervise the work of a reliable pyrimidine chemist, who also will get out the nucleic acid and determine what pyrimidine bases are present in it. I may say that the presence of thymine has been recorded by several investigators, and cytosine and uracil have been looked for, but the results are incomplete and confusing.

There is desire for much investigation on the proteins present, because, of course, the phenomena of hypersensitiveness are the result of protein sensitization. It seems ridiculous that having known that fact for years we have so far failed to devote much attention to learning of what type those proteins are. We know the qualitative composition, to a certain extent, of the hydrolyzed proteins — Tamura has furnished us with a list of some of the amino acids present — but we do not know what the particular types of proteins present are. I plan to use some of my six pounds of tubercle bacilli on this problem.

Leaving the subject of the chemical composition of the tubercle bacillus for one with which I have more personal acquaintance, I should like to say something about the metabolism of the tubercle bacillus and some other acid-fast organisms. One of the best leads I know about in this field was furnished fifteen years or more ago by Theobald Smith, who noted that in the cultivation of tubercle bacilli on glycerol broth the media went through first an alkaline, then an acid phase. These changes have not been accurately accounted for chemically, partly, I believe, because we have used too complex media for the purpose. Commercial peptone is an awful mixture of things, and meat extract is much worse. I am engaged

at the present time in running Theobald Smith curves on media of simple, known chemical composition, and trying now to understand the first or alkaline phase. I can think of just three ways in which culture media, glycerol-peptone broth, let us say, can become alkaline as the result of bacterial growth. One is by the splitting of amino acids or acid amides, which of course make up the bulk of peptone, into ammonia and an organic acid, with destruction of the acid or incorporation into bacillary substance, and excretion, or at least slower utilization, of ammonia, leaving a preponderance of this substance in the medium.

The second is by the decarboxylation of these amino acids, carbon dioxide being driven off and alkaline substances, the amines, being left. This theory was quite attractive to me two years ago because at that time I believed the tubercle bacillus would grow on methyl and ethyl amines as sources of nitrogen, and thought that it might be by this amine route that the corresponding amino acids, namely glycocoll and alanine, were broken down. I have since concluded that those results were due to impurities, chiefly ammonium chloride, in the preparations and that the tubercle bacillus will not grow on amines, and that therefore these are probably not evolved in its catabolism of the amino acids of its food supply. The point is one of considerable importance, as the amines are very potent substances, physiologically considered. Take some examples. In the suprarenal gland we apparently have the amino acids tyrosine and phenylalanine decarboxylated and otherwise slightly modified and converted into the highly active epinephrin. At least one investigator believes that the hypophysis decarboxylates some of the histidine which reaches it and turns back into the blood stream the very important substance histamine. If the tubercle bacillus is one of the decarboxylating organisms might we not think of the tubercle as a ductless gland, also turning into the blood stream some of these decarboxylated amino acids? The idea has received some attention, especially with reference to the production of histamine. I have proved that the tubercle bacillus is able to use histidine as its sole source of nitrogen, and Drs. Koessler and Hanke by their new methods have shown that histamine is not produced from histidine present in the medium, but that one of the corresponding deaminized organic acids, imidazol-propionic, pyruvic or lactic acid, is. These are innocuous substances.

The third possibility I had in mind to account for the alkaline tide is the withdrawal of phosphoric acid from the neutral phosphate present, for the construction of nucleoproteins and phospholipins, leaving the bases behind. I am convinced that this process plays some rôle, although it is probably small in comparison with possibility number one, which I outlined a moment ago, ammonia production.

Before leaving the subject of the Theobald Smith curve I should like to describe a simple method of following it, which saves time, and an immense amount of incubator space, obviating the necessity for the large number of cultures used where titrations are carried out each week. The method is not new, a similar one having been first used by Frothingham.

I carry the procedure out as follows: A plaque of tubercle bacilli approximately 1 centimeter in diameter, less if necessary, is planted on 10 cubic centimeters of broth in a test tube 1 inch in diameter, the broth being exactly neutral in reaction at the start, being either glycerol-peptone broth or a special medium, and containing 0.001 per cent. of phenolsulphone-phthalein, which passes through a characteristic series of color changes between the hydrogen ion concentrations PH 6.4 and 8.4. At weekly intervals the tubes — I run the experiment in quadruplicate — are compared with standards containing the same concentration of indicator at different reactions, and the reaction curve is plotted. When 10 cubic centimeter amounts are used in well sealed tubes the whole procedure takes about two months. Obviously it is much simpler than the titration method. This work is not quite ready for publication, but I may say that for H_{37} and B_1, on glycerol broth, respectively human and bovine type strains from Saranac Lake, I have secured curves quite comparable to those usually obtained by titration methods. The results on media of known composition are not yet as characteristic as I had hoped, and yet I believe that it is only by the use of such media that we shall ever be able to interpret the phenomenon. With certain saprophytes, such as smegma and grass bacilli, where glycerol need not be added, where a single amino acid, such as alanine, or acid amide, as propion-amide, suffices for both carbon and nitrogen, striking results have already been obtained, which will be published in the near future. They furnish very clear indications as to the protein metabolism of these organisms.

Inasmuch as the amino acid alanine can be considered as a type form for many members of the group, the ring compounds tyrosine, phenyl alanine, tryptophane and histidine, being simply substitution products of it, I am concentrating my attention on the products obtained from it, being at the present time engaged in the analysis of two liters of an alanine mixture upon which H_{37} was grown for one month. I am hoping to detect either ammonium lactate or ammonium pyruvate, ammonium propionate and ethyl amine, the other two possible decomposition forms, having been apparently ruled out.

In the investigation on metabolism up to the present time I have run perhaps five thousand cultures of acid-fast organisms on media of known composition. Little of this has been published so far, as I confess that up to the present time I have only accumulated many details without being able to establish broad general principles with which the details may be correlated. Bacteria, while chemical reagents, are very complicated reagents, not always of standard purity, so that many times the expected reaction does not take place and is replaced by another. Even so, I believe they are more reliable reagents in our work than the higher forms of life, such as guinea pigs.

A brief summary of the details which have been observed should include the following facts: In general I have found, using human, bovine, and avian tubercle bacilli, frog, turtle and fish bacilli, leprosy bacilli, smegma bacilli, and several strains of grass and mist bacilli, that nitrogen is readily

abstracted from the amino acids, alanine, leucine and histidine, and used successfully as the sole source of nitrogen. One conspicuous exception lies in the inability of my two avian strains to utilize alanine; they deaminize leucine readily, however. The tubercle bacillus is able to thrive with alanine, leucine and histidine as sources of nitrogen, but not with trypto-phane or phenylalanine. It might be thought that deaminization of these compounds did occur, but growth did not proceed because the resultant product was toxic. As you know one theory accounts for the stoppage of bacterial growth in old cultures on the ground that a high concentration of toxic products has been reached, for example, from the tyrosine of the medium, which is nothing more than alanine with one hydrogen atom replaced by a molecule of carbolic acid, or from phenyl alanine where the replacement is with benzene. However, such reasoning cannot explain the failure of the tubercle bacillus to grow when phenyl alanine is supplied as the sole source of nitrogen, for when alanine is supplied in addition growth does occur.

As regards the utilization of the carbon in amino acids for structural purposes, it may be said that tubercle bacilli are unable to synthesize all their body substance from the material left after the abstraction of nitro-gen. They need something else, best glycerol. Leprosy bacilli can slowly build up their organic body substance, all of it, from alanine or leucine. Frog, fish and turtle bacilli do the same thing a little better, but seem unable in general to split the ring compounds, such as tyrosine, trytophane and histidine. The same statement may be made of the various grass bacilli, except that they do seem to split the imidazol ring of histidine. I am in this case, of course, taking it for granted that growth on histidine as sole source of both carbon and nitrogen means a splitting of the ring, as, naturally, proteins cannot be built up simply from piled up histidine molecules, and we have no evidence that bacteria take the straight chain for structural purposes — I grant they may oxidize it off — and throw the ring away. No organism of the group seems able to utilize tryptophane or tyrosine as sole source of both nitrogen and carbon. Inasmuch as some of the saprophytic acid-fasts are able to thrive on tryptophane and phenyl alanine when glycerol is supplied as an additional source of carbon, I take it for granted that the failure to grow on the ring compounds without glycerol indicates the inability of the organisms to split the indol and benzene rings.

As regards the utilization of nitrogen in other forms, I have found that propionamide is readily deaminized by all organisms of the group, that ammonia is a sufficient source of nitrogen for all members of the group, that creatinine, which contains imino, but not amino nitrogen, is used for nitrogen fairly readily by smegma and grass bacilli, somewhat sparingly by frog, fish and turtle bacilli, less readily still by leprosy bacilli, and by tubercle bacilli, as far as I can detect, not at all. Urea, which may be thought of as an amino acid amide, is used readily by all forms except tubercle bacilli, turtle and fish bacilli. The ready use by leprosy bacilli is noteworthy.

No study of nutrition nowadays would be complete without a consideration of vitamines. They have been described as favorable to the growth of a variety of bacteria by several investigators. To be brief, I have not been able to demonstrate any growth increase with tubercle bacilli or other acid-fast organisms following the addition of certain market preparations of water-soluble (yeast) vitamine, or at least any increase which could not be duplicated by the addition of an "aminoid" mixture in which no vitamine constituency was supposed to be present at all. On the other hand I have been able to prove that certain amino acids are useful *per se*. You are doubtless familiar with the work of Osborne and Mendel and others who have shown that in mammalian metabolism lysine and tryptophane are necessary for growth and maintenance. I have been able to show that lysine, while not necessary to the growth of the tubercle bacillus, is at least desirable, for when you take two proteins, otherwise fairly similar, the one, edestin, containing lysine, the other, gliadin, being practically lacking in this substance, and prepare peptones from these and grow the tubercle bacillus upon them, you will find that the better growth occurs on edestin, the one with the amino acid lysine.

In conclusion let me recapitulate the problems that I am considering, the study of which is being facilitated by a grant from this Association. First there is the type of nucleic acid present — what are its pyrimidine bases and what is its carbohydrate? Second, what sorts of protein are present in the tubercle bacillus? Then there is the subject of metabolism. How is phosphorus used? In the nitrogen metabolism how are amino acids broken up and what is the bearing of this breakdown on the reaction change of the medium? What happens to the cyclic amino acids, those substances from which pyhsiologically active compounds are produced so readily? And lastly — a problem I have not touched yet — what is the rôle of glycerol in synthesis? This is a large order, and yet it touches but a few of the problems we must clear up for a moderately complete knowledge of the life history of the tubercle bacillus.

ARRANGEMENT OF THE MUSCULATURE OF THE BRONCHIOLI AND ITS RELATION TO CERTAIN PATHOLOGICAL CONDITIONS IN THE LUNG*

By William Snow Miller, M.D.

Madison, Wis.

(Abstract)

The bronchial musculature is not arranged in the form of distinct bands which encircle the bronchi and bronchioli, neither is it in the form of a continuous sheet, but it is in the form of a network that is made up of geodesic bands which prevent any tangental motion, and in this way provides for the greatest amount of strength and at the same time permits the greatest amount of extension and contraction of the bronchi and their subsequent subdivisions.

The muscle bands form a sphincter about the openings of the alveoli into the bronchioli respiratorii and ductuli alveolares; they also form a sphincter about the openings leading into the atria. These bands belong to the musculature of the bronchial tree and not to the air spaces.

Distal to the openings leading into the atria no muscle has been found. There is no muscle in the walls of the air spaces.

In asthmatic attacks the muscle about the openings leading into the atria is contracted thus reducing the size of the openings. The muscles of inspiration are more powerful than those of expiration; this leads to an accumulation of residual air within the air spaces with its accompanying distress. With the relaxion of the contracted muscle the openings again become patulous, the excess of air almost immediately flows out and the attack is over.

In the fibrous scar tissue of "healed tuberculosis," where the apex has contracted, small herniae of the mucosa are frequently seen in longitudinal sections of the bronchioli. These herniæ are lined with columnar or cuboidal epithelium. They have broken through the wall of the bronchiolus at the point of least resistance and there will be found on either side of the point where they have pushed their way out a band of muscle cut transversely. These herniæ frequently develop into those cavernous spaces which open into the lateral wall of a bronchiolus.

The size and position of the lungs are constantly changing with the respiratory movements. If the condition of the lungs at the end of a

*Work being done under grant of the Committee on Medical Research of The National Tuberculosis Association.

This paper will appear in full in the American Review of Tuberculosis.

normal expiration be taken as a starting point it will be found that in the act of inspiration they increase in extent, especially that portion of each lung that is directly influenced by the descent of the diaphragm. This increase in size has its influence on the bronchial tree and especially on the smaller bronchi, the bronchioli and their subdivisions.

In extreme expiration the branches arising from the main stem bronchus form an acute angle with the main stem bronchus, while in inspiration they open out, and the angle becomes wider and at the same time they elongate. This change is necessary in order that provision may be made for the expansion of the air spaces.

The action of the bronchial musculature in expiration is active rather than passive.

THE FINER DIVISIONS OF THE AIR SPACES IN THE LUNG OF MAN AND SOME OF THE LABORATORY ANIMALS*

By William Snow Miller, M.D.

Madison, Wis.

(Abstract)

There are in use at the present time three schemes of the ultimate arrangement of the air spaces in the lung; that of Kölliker; that of Schulze; and that of Miller. Of these, the last two are most frequently used in technical descriptions of the lung.

The description given by Miller of the ultimate arrangement of the air spaces in the lung of the cat, of the dog, of the ox, and of man is the only one based on a critical analysis of the air spaces.

The subject has recently been reworked by the author with the aid of new reconstructions made from sections of the human lung, and there was not found any occasion to change previous statements.

DISCUSSION ON PAPERS BY DR. MILLER

Dr. Lawrason Brown, Saranac Lake: Twenty-six years ago, when I studied histology under Professor Barker, he referred us to the works of Miller as the best authority on the anatomy of the lung. I thought, of course, that he was a German, and was very much surprised to find some years later that he lived in Madison, Wisconsin. At that time, his best article, I think, was published in Buck's Reference Handbook of the Medical Sciences, and curiously enough, from that day to this, the best article on the lungs has always appeared in that book. Some of his friends have been very anxious to have him, and have been trying to persuade him, to bring together his knowledge of the anatomy of the lung that he has published from time to time in various articles in the form of a little book to which all of us interested in the study of diseases of the lungs might have ready access. Those of us who have to teach it, who have to go over his articles from year to year, know what difficulty we have in bringing together all these various data.

For instance, what structures does the parenchyma of the lung possess?

* Work being done under grant of the Committee on Medical Research of the National Tuberculosis Association.

As the paper is a purely technical description of lung structure it will be published in one of the anatomical publications.

Does it contain lymph spaces? He says not, and he now also says that it contains no muscle.

I am glad to tell you that he has at last consented to bring together all this knowledge in the form of a little book to be at our disposal in about a year.

NORMAL RADIOGRAPHIC APPEARANCE OF THE CHESTS OF CHILDREN*

A Symposium

(A) Kennon Dunham, M.D., and Kenneth D. Blackfan, M.D.

Cincinnati

(B) H. K. Pancoast, M.D., and H. R. M. Landis, M.D.

Philadelphia

(C) Charles R. Austrian, M.D., and F. H. Baetjer, M.D.

Baltimore

The Chairman: We have for consideration a series of papers forming the Symposium on Normal Radiographic Appearance of the Chests of Children. The first paper is by Dr. Kennon Dunham and Dr. K. D. Blackfan of Cincinnati. Dr. Dunham.

Dr. Dunham: At a meeting of the men brought together by Dr. White yesterday to discuss some of the research problems, this committee or portion of the committee represented by Dr. Blackfan and myself, explained very clearly to the men gathered together, that what we wished to report was ignorance, and all we have to say is published in one little article in these abstracts. What we would report principally, as I said before, is ignorance of the normal chest, and we wish to emphasize the fact that that does not apply to the x-ray examination of the normal chest of the child from six to ten, but that that applies also to our knowledge of the normal physical chest in the healthy child of from six to ten. If this committee brought home to us nothing more important than that, we felt that we had learned a great deal. For when we sat down to pick out normal children from which to make and secure the data of normal x-ray plates, we found a thing which we should have known before, but which we did not know, that our best nourished children in the institutions about Cincinnati, which we studied, were located in our tuberculosis sanatorium.

With that point, we started out to see why it was and what was wrong, and we found that in the adult we could work out a basis of what was the normal physical examination, and we could have written something about that because other men had gone before us and marked out

* Work done under grant of the Committee on Medical Research of the National Tuberculosis Association. This is a preliminary report of the work which is being continued through further grant from the Committee.

the way. But when it came to the child, when we commenced to study the physical findings of the child, to use that same basis was sure to be wrong. We were informed that the breathing of the child was pleural. We found it so; there was more bronchial breathing in the child. But as to how that varied in the various parts of the lung, how the diaphragm moved, the size of the heart and its relation to the breaths and breath sounds, with regard to the trachea, and the various parts of the lung which are farther away from the trachea, we found that we had to chart practically a new field. So we threw up our hands early in the game and said, "This is a bigger job than we are going to be able to encompass at this time. We are going to ask the committee to be continued." We then sat down to determine what x-ray technique we would use, and that is all we have reported.

We proceeded to go then, from the x-ray laboratory, and pick out the plates which we thought were the best, and we found that those which were best were taken by the technique printed here. We decided to lay out a yardstick by which to judge those plates, and the yardstick which we picked out was: that a plate should be best which would give us the greatest information with regard to the anatomy of the lung. I will, therefore, read you what Dr. Blackfan and I were willing to place our names to at this time.

NORMAL X-RAY PICTURES OF CHILDREN BETWEEN THE AGES OF SIX AND TEN YEARS

Varying x-ray techniques have been tried upon 300 children for the purpose of determining a "norm" for x-ray plates, between the ages of six and ten.

It is our opinion, after studying x-ray plates and physical findings of children in the wards and out-patient clinics of the Cincinnati General Hospital and those at the Cincinnati Tuberculosis Sanatorium, that it is difficult to determine which children are normal. It is hoped that in the near future we may be enabled to so study children after accidents, who come to autopsy, that we may arrive at definite conclusions. Such material is available.

The only work that we are willing to report at this time is the x-ray technique which we have concluded to be necessary, after carefully comparing plates and stereoscopic pairs taken by varying techniques.

The object of the x-ray technique should be to secure the greatest amount of lung detail which will enable us best to detect lung anatomy. The following technique has given us the best results. It has been worked out from work done in three x-ray laboratories.

Target distance 39 inches, using medium focus Coolidge tube with a 9-inch spark gap carrying 40 m. a. of current has been selected. The exposure time is ¼ second. Stereoscopic plates are essential. The child is placed in the upright position and the principle ray of the first exposure passed through the center of the spine just below the spine of the scapula.

The tube then shifts parallel to the spine for 4 inches and the second exposure is made near the angle of the scapula. The child's head is maintained in the median line with chin upon the plate. The hands are placed in the lap and the shoulders and elbows are brought forward to touch the holder.

We consider stereoscopic plates made with short exposure, long target plate distance and high spark gap with heavy current essential. The other points of technique have been selected because they are good and not because they are known to be best.

We have found it so vital to the prosecution of this research that we have invited Dr. Austin, Professor of Pathology, University of Cincinnati, to join us in solving these problems.

The Chairman: The second paper of the symposium is one by Dr. Pancoast and Dr. Landis of Philadelphia. Dr. Pancoast.

Dr. Pancoast: Personally, I want to thank this Association for giving us this work to do, because I have never undertaken any work in the x-ray line that has been of more value to me. I do not know what the normal chest of a child should look like now, but I am a little nearer to it than a year ago. A year ago I was making diagnoses of pathological conditions, and to-day I am finding the same appearances in the normal chest. It seems to me that the work is going to be of value to both roentgenologists and internists, because we are trying to establish what should be normal in the x-ray plates of chests of children.

I do not believe that we shall ever be able to pick out a chest, roentgenologically speaking, which we can say is absolutely the normal chest of a child. I have not found one yet, in the one hundred cases we have selected, and in going over most of these stereoscopic plates we have not found any particular set that we could pick out and say, "This is a normal."

I do believe, however, that we shall be able, after going over all our chests, to make up a hypothetical normal, to say that certain features in the child's chest are normal and that the normal chest of the child must tally with that.

We had the same trouble with the stomach years ago. We learned in a short time that there is no such thing as a normal stomach, strictly speaking, from the x-ray standpoint.

I do not believe that the technique makes so much difference except in certain essential details. We have made, in every case, a thorough fluoroscopic examination in each instance. We have measured the diaphragm levels on the plates, and on the fluoroscope we have measured the width of the heart and the aorta, and recorded everything we could. We have not yet reconstructed any definite conclusions from the data we have obtained. That is the biggest part of the work.

Dr. Landis and I went to White Haven in the spring, and picked out twenty-seven children from an orphan asylum. These were presumably healthy children who had experienced comparatively few infectious diseases, many of which may affect the appearance of the chest, more or

less. The only essential difference that I have been able to find, so far, between the chests of those children and those of the city dwellers, is that the children who were living in the mountains, taking more exercise and possibly having to get more oxygen into their lungs because of the high altitude, exhibited a much greater range of diaphragm movement. Their average of one and a half to two inches was a remarkable amount of diaphragm movement as compared with three-quarters of an inch in the city child. The hilum shadows, linear markings and glands in the hilum were practically the same in the two sets of children.

It is interesting to note, in the examination of the hilum, that so far, in going over some sixty of the one hundred cases we have examined, we have not yet found a single child who did not show visible evidence of glands.

I believe that we can construct a hypothetical hilum which will apply to the normal appearance. We are trying to arrange our linear markings in some definite way, but that is the most difficult problem we shall have to settle. It is also noticeable, as we all know, that the heart of the child extends an unusual distance to the right. Of course, the heart of the child is comparatively large when we do make any comparison with the adult. It is important to make some note of the average thickness or density of the linear markings because the roentgenologist wants to compare the chest he examines with something he feels reasonably sure is normal, and it is very important for us to describe the appearance of the linear markings as well as possible.

The Chairman: Dr. Landis will continue this report.

Dr. Landis: I think if the roentgenologist feels it is essential to establish a normal, it is even more essential in so far as physical signs are concerned, because I know of no subject relating to physical diagnosis in which there is so much confusion as there is in the interpretation of the physical signs obtained in the chests of children. The literature relating to physical diagnosis in children, for instance, contains a considerable amount of material which is absolutely erroneous, because a large part of the observations have been made by men whose training has been in the examination of adult chests, and they have tried to apply, in the interpretation of signs in a child's chest, the same standards, not realizing that the interpretation of physical signs in a child's chest is radically different.

For instance, there are several things that are well to bear in mind in this regard. Only recently, I know of an instance in which a child was said to have a pleural effusion and was referred to a roentgenologist for fluoroscopic examination. Nothing whatever was present. The probable explanation is that in young children, if they are sitting in a constrained position, cramped over a little on one side, dullness and almost absent breath sounds are found over the base of the lung on the constricted side. It is essential, therefore, in the examination of children, to bear in mind that they must be kept perfectly straight and in a relaxed condition.

While it is not perhaps absolutely germane to the chest, it ought to be known, as it is apparently not as well known as it should be, that between the ages of two or three and up to the age of puberty every superficial lymph node is easily palpated. If, during this lymphoid age all of the lymphoid tissue is normally hypertrophied, whatever the social environment may be, it is perfectly obvious that the bronchial and tracheal lymph nodes will be equally large. I know it happens quite frequently to a number of us that a child is brought in with the statement that an x-ray examination has been made, and that the tracheal-bronchial lymph nodes are reported as being enlarged, and probably tuberculous. It has been my experience that if these lymph nodes are tuberculous, the infection lacks the seriousness which many attach to it.

In every child, in this age period that we have examined (and the younger the child the more markedly is this present) the right border of the heart extends to a very considerable distance beyond the right border of the sternum. What would be pathological in an adult is a perfectly normal finding in these children. The right border in most instances, extends a finger's breadth to the right. If the right heart of an adult extended over that distance it would be the clearest evidence you could have of enlargement of the right heart. Only recently, I heard of an experienced clinician who believed a child had a dilated heart because the heart extended over so far, apparently being ignorant of the fact that it is a normal thing at that age period. It has been known for some years, though not as widely as it ought to be.

Another finding almost constant in all these children, and one that constitutes a part of their normal make-up, is an area of tympany over the base of the left lung. It is a thing constantly present, more marked in some instances and less in others, probably due, I suppose, to the condition of the stomach.

I was interested somewhat in the question of whether it was possible to make out anything regarding the thymus. In some of the cases I questioned the possibility that a thymus might be normally enlarged. I have not yet been able to compare those cases with Dr. Pancoast's findings.

Another sign that is very much to the front and one upon which a great deal of reliance is placed by many observers, is the D'Espine sign. The presence of this sign is cited frequently as fairly good evidence of enlargement of the tracheo-bronchial lymph nodes. I think it is like many other physical signs — so much depends on the personal equation. What I might consider a positive D'Espine someone else would not consider as being present, and vice versa. It is a sign, so far as I can see, that is very elusive, and very difficult to interpret; it is not easy to draw any definite conclusions from it. I have certainly obtained it very distinctly in children in this group, in whom I had not the slightest reason in the world to believe that anything was wrong. In others, where I might have a suspicion that there might be something present about the hilum, as far as I could see, the D'Espine sign was absent.

Another thing that this study has forced on my mind, and it is the accumulation of some years of experience in examining children of this period, is that all the acoustic signs in a child's chest are tremendously exaggerated, and nowhere is it more true than the right apex. Some years ago, I took occasion to go over a number of children, at the time when we were making a good many diagnoses of pulmonary tuberculosis, and before we came to recognize that there are two types of tuberculosis, the adult and the infantile types. You rarely see the adult type in children just as you rarely see these extremely acute forms, comparatively speaking, in the adult. In this group of children said to have tuberculosis of the lung, ninety-eight per cent. of them were charted as having a lesion at the right apex. We know that at the right apex in the adult the signs are a little different from what they are at the left, owing to the close proximity of the trachea with the apex of the lung at that point. In a child those changes are enormously exaggerated, and they have to be interpreted with a great deal of care. The mere fact that these signs are present is no good proof that you are dealing with a pathological condition.

Scanty as these results are, I feel that the study is well worth going on with, until we can establish pretty definitely what one can ordinarily expect to find in children under normal conditions.

The Chairman: The third, and concluding paper of the symposium, is that of Dr. Austrian and Dr. Baetjer, of Baltimore. Dr. Austrian.

Dr. Austrian: If senescence begins at birth, then the changes that come with senescence must be evidenced in the lung, perforce, as elsewhere. Social status, with its environmental influence, with its greater or lesser incidence of acute infections, must leave some evidence of ravages in the lung. More important, subliminal infections, past and overlooked, leave markings that will require interpretation, and all of these factors, plus the variation in the anatomical variations in the lung, must be considered in making up the composite lung picture.

Recognizing these facts, we have realized from the beginning that such a study as this, to be of any value at all, must be based on careful examination, and, it must be apparent to all of you, repeated examinations must be made at intervals over considerable periods of time.

To approach the problem ideally, of course, one would examine normal children, and autopsy them to check up one's findings! Unfortunately, we can't do that! One might take the stand that the radiographic results were to be the sole criterion of normal conditions, but the x-ray furnishes only one bit of evidence, and therefore cannot be chosen. Therefore, the problem narrows down to the examination of apparently healthy children, finding they are negative in as far as we can, checking these observations with laboratory study and then taking an x-ray, and seeing how far the findings can be brought into relationship.

We find it is vital that children be taken from every social level. Findings of children from the slums, and those of children from the higher levels, will differ. The same is true with regard to country and

city. For that reason we have chosen children from hospital clinics, from private clientele, from sanatoria, and from orphan asylums, and tried to get a view of the whole group.

In the past five years we have intensively studied a group of nearly five hundred children, whom we have examined over varying periods of time, but for this meeting we are to talk about eighty healthy children, picked more or less at random.

SUMMARY REPORT OF EIGHTY CASES

Total 80 cases. Age range 3 to 13 years (17 cases 6 years or less).

Group I

32 cases had negative physical examination, x-ray and von Pirquet.

5 cases had negative physical examination, x-ray with von Pirquet positive.

Group II

Physical examination, pathological. X-ray normal.

3 cases.

1 had acute bronchitis.

2 had crackles at an apex with prolonged expiration and both of these had positive skin test.

Group III

10 cases had abnormal findings on physical examination and x-ray.

2 only had von Pirquet positive.

8 had von Pirquet negative.

Of the 2 with von Pirquet positive:

1 had clear lungs on x-ray with enlarged mediastinal glands but on physical examination had slightly impaired percussion note, prolonged expiration and musical râles at apices. His mother has tuberculosis.

1 had no signs of increased density but râles in left s. s. fossa. X-ray showed fibrosis of left apex.

Of the 8 with abnormal findings on physical examination and x-ray with negative von Pirquet:

1 had positive D'Espine sign only and x-ray showed no mediastinal enlargement.

1 had positive D'Espine sign and signs of bronchitis with a non-tuberculous lesion at the right base.

1 had signs of bronchitis and x-ray showed marked root changes.

1 had very slight impairment at the apices and on x-ray showed localized infiltration beneath both clavicles.

1 had slight impairment at right apex without other signs, and x-ray showed a bilateral fibrosis.

1 showed no signs of lung infiltration but scattered musical râles

and x-ray showed old fibrosis of left apex with enlarged mediastinal lymph glands.

1 showed harsh, high pitched breath sounds with coarse and musical râles and on x-ray examination showed remains of bronchopneumonic patches at right base and upper lobe with enlarged mediastinal glands.

1 (tonsils and adenoids) showed detectable impairment at right apex with signs of diffuse bronchitis — x-ray showed fibrosis both uppers slightly greater on the left.

Group IV

30 cases.

Physical examination normal. X-ray pathological.

11 showed basal lesions and of these 3 had fibrosis of upper lobe in addition.

14 showed fibrosis of upper lobe and 3 had basal lesions.

8 showed mediastinal glands or increased root shadows and of these the lung fields proper were clear.

2 had a basal lesion alone.

3 had positive von Pirquet reaction.

27 had negative von Pirquet reaction.

Of the 3 with positive skin test 2 showed fibrosis of upper lobe and 1 of a base.

This brief summary will illustrate the confusion we have come into as a result of the study, to date, but we feel that the problem is one worthy of solution. It is a difficult one, time will be needed to solve it, and the work cannot be hurried. It cannot be a fabricated research, as far as I can see.

The Chairman: Does Dr. Baetjer wish to add something to this report?

Dr. Baetjer: I just want to speak briefly, rather in continuation of what Dr. Austrian said. If I wanted to bring you a plate illustrating one of these thirty normal cases, I would have to bring all thirty plates. In other words, a normal is one based upon previous experience, where we have a composite picture, and which varies very materially. That is the point we have wanted to determine, and we had to have some basis to start from.

Some years ago, we took children, a day old, from obstetrical wards and made a routine examination of them, where the mother was normal, yet we found tremendous changes. We couldn't find one that was normal. So that I am speaking of the hypothetical normal, which I do not believe exists.

We were struck, in our study, with the great number of variations, and I may say in this connection, that while we reported what was called a pathological group, about which Dr. Austrian and I differed so materially,

for practical purposes the vast majority were passed up as of no significance.

Now, it seems to me that the problem that is before us is a difficult one indeed, because after all, what we are working for is how it affects the patients, and the question of variations is so large that we may class a number of variations as the result of a number of things.

As illustration, suppose there is a marked scoliosis. We are bound to get changes in the lungs due to the defect in the thorax. Also, suppose we examine a child, say fifteen or sixteen, who has had a marked attack of rickets. We know with rickets that the sinking in of the sternum does interfere with the respiratory movements of the chest, and we get marked pulmonary variations and changes there which probably last, and signs are even present in later life.

Then comes the question of lesions in the past. For example, we see remains of fibrosis or sometimes little batches of consolidations that have never cleared up, in perfectly normal individuals. Are we going to call that a pathological condition? Probably it will have no effect on the patient. But are we going to call it a pathological lung when the child is perfectly normal in every respect?

Then we noticed too, in adult life, that there is a marked increase in the linear markings of the lung. For instance, we would call a patient perfectly normal as an adult, that at sixteen we would call a pathological condition. So that very many variations enter into the question.

Personally, I do not believe that we are going to have a definite normal lung. Now, we can examine a tibia and say that it is normal or it is not normal, but you cannot do that with reference to the lung. Our normal lung has got to be a composite picture and one which you could describe as being possible. If we can bring that out and prove that to be the case, we shall have done an important thing. In other words, going as far as we have, drawing conclusions, partly on the cases we have seen and based on previous examination, I believe we shall never be able to get a plate which we can hold up, and say, "Any variation from this is abnormal." I have a feeling to-day that, in the working out of this problem, our results are going to be negative rather than positive. Just as Dr. Austrian and the other speakers have emphasized, it seems to me that this problem must be continued. Certainly it is a very serious problem, indeed, because when one sees the variations, or rather the difference in diagnoses, and also the great stress which a great many physicians place upon x-ray findings, it seems to me that it is now time to get at some workable basis, if it is possible, so as to reduce this great number of variations. Frequently, the x-ray is given too much importance.

If the work is stopped here, it is my opinion that while we have accomplished something, probably the work as a whole and the money spent has been thrown away. This is a problem which should continue over a number of years, because, as Dr. Austrian pointed out, the real significance of this is to find out whether these abnormal markings that we see, and which for the want of a better term we speak of as patho-

logical now, are of real significance in after life. Sometimes I think that a normal in either physical or x-ray examinations will have to be determined from the standpoint of an economic normal.

The Chairman: Dr. Baetjer's report closes the formal symposium. The subject is now before you for general discussion.

DISCUSSION ON SYMPOSIUM

Dr. James C. Thompson, New Haven: It seems to me that Dr. Dunham's statement as to technique is one of the most important things that has been brought out. For all x-ray men to study this subject on the same basis, it seems absolutely necessary that we all work out the same technique. We know that the difference in technique has been productive of many differences in conclusions. If we get plates of the same density, bringing out the same detail in all cases, we shall be able to coördinate our conclusions.

Dr. L. J. Moorman, Oklahoma City, Okla.: I am very much interested in this symposium in connection with the x-ray of the chests of children, but I must confess that I am going to leave this meeting with a considerable degree of disappointment, because I came hoping to get some standard which might guide me in my own work. In Oklahoma City, in the tuberculosis dispensary, we have examined something like six hundred children varying from three to twelve years of age, most of them probably from five to ten years. In these children we have recorded social history, clinical history, the physical examination, and I think probably in two hundred and fifty of these cases we have had x-ray plates, and in only one or two we might say there is practically an absence of evidence of enlarged tracheo-bronchial glands. Two years ago I undertook to compare with contact cases that were x-rayed, a number of normal, or apparently normal children. (I think when we start out to study a question like this, it is safer to say "apparently normal" children.) I had blanks prepared, and with the coöperation of the school physician, we went into the better sections of the city, and by working with the principals of the schools, we had these history blanks filled out, and sent to the parents for signature, authorizing the examination of these children. Unfortunately the schools closed before we succeeded in getting many of the children, but we did make twenty examinations. The children were chosen on account of their apparently normal condition and good record of attendance at school.

I was very much surprised to find about the same degree of x-ray evidence in these apparently normal children that we found in contact children; and I was also surprised to find that in some of these so-called normal children we found a temperature above 99.5, just as we found it in the contact children that came through the dispensary.

Dr. J. H. Holbrook, Hamilton, Canada: Like the previous speaker, I hoped I could come here this morning and have all my difficulties in

the interpretation of the x-ray plates of children, cleared up, but I am still very much at sea.

For several years now, we have been treating children whom we have diagnosed as having active pulmonary or bronchial gland tuberculosis, but if we had depended for our diagnosis on the x-ray findings instead of on the physical signs and the symptoms I fear we would have had difficulty in deciding which children should receive treatment.

We know positively that a great many of these children were tuberculous, however, and it seems to me that these reports which we have heard this morning simply mean that we must go on taking everything into account — the history, physical signs, symptoms and other conditions as well as the x-ray findings.

I have two or three ideas which this morning's reports have served to emphasize. One is that if there is not a normal x-ray finding for the chest of a child, then we adults are all abnormal. Or to put it in another way, we adults are very highly specialized individuals that have gained our immunity to the various infections that everyone is subject to by actually having had those infections, and the fight is carried on in the lymph nodes of our own bodies, and especially in the cervical and bronchial lymph glands.

Without having successfully gone through these infections in childhood we could easily fall prey to the infections to which adults are continually exposed, if we were to meet them then for the first time.

Now the bearing of this upon the tuberculosis problem is simply this: that practically every adult has been infected with tuberculosis, and the majority have gotten the better of their infection. That infection took place in childhood in the majority of cases, and we cannot say absolutely whether the changes we see so early in the x-ray plate of the child are tuberculous or non-tuberculous changes. But we must realize that changes due to tuberculous infection are going to take place, and that it is our duty to find the cases that are suffering from active disease.

Now it seems to me that while these reports are very valuable in showing our difficulties, yet this Association has a great responsibility upon its shoulders, in that the work of school inspection is spreading throughout the land and we must give the workers in this department of medicine some definite ideas on the diagnosis of early types of tuberculosis in children. I believe absolutely that in ten or fifteen years, community medicine will have advanced to such a point that it will be considered a reflection upon tuberculosis workers to let their cases go on to adult years before the condition is diagnosed, because in a great many cases it could easily have been diagnosed in childhood. We must go on studying this problem, see all the difficulties, and then bring out a standard which shall be of assistance to the workers who may not be specialists in tuberculosis, but are engaged in the work of school inspection, for it is they who have the best opportunity of discovering the great majority of the cases of tuberculosis when it is first possible to make a positive diagnosis. It is a far better thing to treat tuberculosis in the

least valuable period of a human being's life — childhood — than to let it go on to adult years, and these reports on the x-ray findings in childhood are very valuable for what they do not say rather than for what they do say.

Dr. W. L. Dunn, Asheville, N. C.: I do not think that any of us have seriously expected that this committee would be able to come to very definite conclusions in this short period of time. It was the difficulty of this subject that made the committee undertake the work. It was because of the fact that negative x-ray findings in clinical children left us in trouble, and that positive x-ray findings in apparently well children left us in doubt, that this work was so important.

I think one important thing has been brought out, and that is the standardization of technique. It is perfectly true that no particular technique seems to bring us an answer to our question, but until we work with a definite technique — not until then, and only then, can we hope for results.

I would like to make one suggestion, and that is this: Many men do not retain the plates in their libraries. The retention of these plates that we have taken of children, and the opportunities that will come from time to time to take plates again of those children a few years later or even in adult life, must eventually bring us very valuable information. I think we will eventually arrive at very definite results if we will retain the plates of children that we have examined, for whatever reason. It is well worth while.

Dr. Henry D. Chadwick, Westfield, Mass.: I recently examined a group of school children in order to find out, if possible, the relation of malnutrition to tuberculosis. I selected a school of about 625 children, had them weighed and measured, and found there were 28 per cent. of them suffering from malnutrition of 7 per cent. or more.

Of that group we examined 148, and found that 83 had suspicious pulmonary signs. At a subsequent examination, devoting more time and under quieter conditions, we found 48 of these to have definite signs of what we considered infection of the tracheo-bronchial glands. That 48 constituted about one-third of the malnutrition group and equalled 7 per cent. of the children in the school. I was able to get x-ray plates from 12 of that 48, and they showed large glands about the hilum with more thickening of the hilum structures than we usually see in the average child. I was in hopes of learning from the readers of the papers of a standard so that I could classify these children in a more intelligent way.

I think we must emphasize the fact that the physical signs that we find in childhood are entirely different from the physical signs that we find in adults, and we must not give them the same interpretation. We must not expect to find early signs of tuberculosis in the apices of children. We must depend on the percussion between the scapulae and any increase in the area of dullness at that point and extending up into the apices, is likely to be pathological. I think, too, that the position of the child, when examined, is of great importance. A child should be stand-

ing squarely on both feet. Never examine the child lying down or sitting if it can be avoided.

We have found the same thing true in regard to the position of the heart. In many of the children, the heart is centrally located. On x-ray examination we find it extending beyond the right border of the sternum as much as we do to the left.

Dr. Samuel Swezey, Denver: I think that probably one of the most important points in the technique of taking x-ray plates is the length of time of exposure. The most serious obstacle in the way of obtaining a good plate is the movement on the part of the various organs of the chest. Every time there is a contraction of the heart a wave is sent through from the heart throughout the periphery of the lung. You can see it plainly in the fluoroscope, especially in the part of the lung which immediately surrounds the heart. Now, that kind of movement must be stopped before we can interpret the various shadows intelligently. It seems to me that a quarter of a second is too long a period to expose a child. I know in Denver some of the radiologists are making beautiful plates by using only a tenth of a second exposure, and one man told me that the time was not far off when they will be able to expose plates for about one-twentieth of a second. I think that this is a very important point, especially when it comes to finding out what is a normal chest plate.

Dr. Paul Johnson, Washington, D. C.: It seems to me that from the standpoint of the dissecting room we have to remember the differences that exist in groups of people. We know, just on looking around here this morning, that there are differences in size, differences in length of neck, shape of body, and so forth. The ordinary anatomical descriptions are descriptions of majorities. The text books on anatomy state that certain differing arrangements of the muscles or viscera are found in other groups in certain smaller percentages.

Now, the police departments, through their physical measurements of criminals, and the anthropologists may all contribute to just such a study at this. We are looking for practical standards, but these must be based on a study which is thoroughly scientific in all its parts. It would seem to me that in order to get radiographic standards there must be a correlation of what the anatomists can contribute, what the embryologists can contribute, and what the physical anthropologists can contribute. I believe that the study will result in the description of several different groups of children, and for each group certain radiographic standards may be deduced.

I believe that the radiographic examination of each child should be accompanied by the physical examination and recording of the physical signs; photography of the child, stripped, would help. And this information for the specific case should be brought into relation with what can be contributed for the entire race by other groups of investigators.

Col. G. E. Bushnell, Bedford, Mass.: I want to emphasize the relation of x-ray findings in the lungs to the pathological histology of the

lungs, which I have not heard anything about this morning. There have been recent observations by Rauke, which I consider of great value, on a child killed in the street by accident, and in other cases of death from other causes than tuberculosis. There was a typical tuberculosis process, what you might call a primary lesion, extending from a focus at the periphery of the lung down to the hilum, which was worked up in serial sections. So that for the first time, as far as I know, that matter has been brought onto a pathologico-histological basis. There were found a series of sheathing, fibrous proliferations involving first, the blood vessels, and then the bronchi — the bronchi only secondarily, but more severely. The observations give a perfect pathological explanation for these localized densities which have been troubling radiologists and which many wish to disregard. Now, the sharper those pictures the older the lesion. A sharp lesion is a perfectly arrested lesion as far as we can judge from the x-ray. But, if you follow a process like that, shortly after it has occurred, if the small lesion is so situated as to be accessible to physical diagnosis, you will find increased congestion, increased dullness on percussion, and increased transmission of breath sounds and all that sort of thing, and in the puerile respiration of the child the signs should be especially clear. One of the defects in the practiced physical diagnosis is that we do not give the minute attention to the auscultation of the respiration that is necessary to determine the existence of strictly localized and small lesions. I think that many do not appreciate how much can be learned in that way. The thorax of the child affords an especially favorable field for such purposes. Therefore, I would like to emphasize the importance of auscultating the areas, which are outlined by the x-ray or discovered by any other method, with extreme care, comparing small areas one with another. I think you will often find evidences of a lesion by this method in an area which at first sight may have appeared to be negative in your physical findings.

Dr. W. B. Howes, Detroit: Since lymphatics play such an important rôle in child life and since we are putting so much emphasis upon the roentgen ray findings of the hilum and tracheo-bronchial glands it would seem to me quite necessary to establish some standard technique which will give us the greatest amount of information regarding this tracheo-bronchial gland complex. I realize that this report is not intended to take up the question of technique but since the study is being made it would seem the part of wisdom to make it as comprehensive and as enlightening as possible. Dr. Evans, of Detroit, has perfected a lateral plate technique which adds much to our knowledge of hilum conditions over what stereoscopic plates give us. I believe it is well worth while to take lateral plates in all cases of children to supplement the stereoscopic plates. I would like to ask the gentlemen who spoke here this morning if they have done any work in this connection with lateral plates or whether their deductions are simply from stereoscopic plates.

Dr. Baetjer: I think if we can bring out quite clearly that so many of these changes that we see are simply abnormal variations, we have

conferred a great boon upon this Association. It doesn't seem to me that every problem has to have a positive finding. A negative one is just as good as a positive. If we can bring out to this Association and to the medical men the fact that we cannot say positively that such-and-such a variation is not tuberculosis, we will remove one of the causes for which so many people have been sent to sanatoria upon insufficient data.

The x-rays are only one of the many ways of examining the patient, and like any other method, it should not be taken alone. So that if we arrive at a negative diagnosis (and we have been at this only two months) and have nothing definite, that is a valuable contribution as far as we have gone.

Dr. Pancoast: The question of technique has been raised. I made the remark that it made no difference what technique was used. This is not an x-ray meeting where technique would be discussed. I perhaps was misunderstood. Dr. Baetjer, Dr. Dunham and myself have used quite different methods, and I believe our work is going to proceed just as well with the technique each of us is using. I do not expect to change mine, and Dr. Baetjer and Dr. Dunham will not change theirs.

Dr. Dunham: I merely want to say that I realize the work of Dr. Evans in Detroit, and I think it will be valuable after we have gone further in it.

The following motion was made by Dr. Alfred Meyer and seconded by Dr. Philip King Brown:

It is the sense of this joint meeting of the Clinical and Pathological Sections of the Association to recommend to the Executive Committee that the grants be repeated to the institutions where these roentgenological studies of the chests of children have been made and that they be renewed if consistent with the condition of the treasury and the acceptance of the work on the part of the institutions involved. *Motion carried.*

PROGRESS REPORT ON THE INVESTIGATION OF THE CHEMOTHERAPEUTICS OF CHAULMOOGRIC ACIDS IN TUBERCULOSIS*

By Ernest Linwood Walker, B.A.S., S.B., S.D.

San Francisco

I. BASIS OF THE INVESTIGATION

Chaulmoogra oil has had an empiric reputation in the Orient for the treatment of leprosy since ancient times. In order to determine whether or not there existed any scientific grounds for this reputation, an investigation of the therapeutic properties of this oil was undertaken in my laboratory in 1918. This was first directed to a study of the method of action, active principle and specificity of chaulmoogra oil. The more important conclusions from this part of the investigation, which was published in the *Journal of Infectious Diseases*, March, 1920, are as follows:

1. Chaulmoogra oil contains substances having a high bactercidal activity.

2. This bactericidal actvity is a property of a series of fatty acids, having a carbon ring structure and peculiar to chaulmoogra oil and oils from certain plants closely related to Hydnocarpus (Taraktogenos) kurzii.

3. The bactericidal activity of the chaulmoogric acids is specific for the acid-fast groups of bacteria, and inactive against all other bacteria.

Meanwhile clinicians, using the salts and esters of chaulmoogric acids, have apparently demonstrated conclusively the curative action of these cyclic fatty acids in leprosy. These therapeutic results have been obtained especially by Sir Leonard Rogers and his colleagues in India with the sodium salts administered intravenously, and by MacDonald, Dean and Hollmann, in Hawaii, with the ethyl esters administered intramuscularly. These latter authors report the parole of 142 patients apparently cured of leprosy during the past two and one-half years.

These two facts, the specific bactericidal action of the chaulmoogric acids on acid-fast bacilli and the therapeutic results obtained by their use in one of the diseases caused by acid-fast bacilli, are the basis of this investigation of the chemotherapeutics of the chaulmoogric acids in tuberculosis.

* From the George Williams Hooper Foundation for Medical Research, University of California Medical School, San Francisco.

Work done under grant of the Committee on Medical Research of the National Tuberculosis Association.

II. SOME PRELIMINARY EXPERIMENTS ON THE TREATMENT OF TUBERCULOSIS IN LABORATORY ANIMALS WITH CHAULMOOGRA OIL AND ITS DERIVATIVES

The use of laboratory animals, such as guinea pigs and rabbits, for the experimental therapy of tuberculosis has its advantages and its disadvantages. Tuberculosis in man is not necessarily a fatal disease and spontaneous arrest and cure of the disease is not uncommon (and is perhaps the rule, judging from our knowledge of childhood infections and of autopsy findings); but in guinea pigs and rabbits, infected with a strain of known virulence, the disease runs an invariably fatal course. Consequently, cure or even consistent prolongation of the average life of the treated beyond that of the control animals in therapeutic experiments can be ascribed with reasonable certainty to the treatment. This is a distinct advantage that laboratory animals have over human patients for such experiments. On the other hand, there is this definite disadvantage that tuberculosis is a more acute disease in laboratory animals than in man and there is consequently less time for treatment and, other things being equal, treatment would have to be more efficient to obtain cure of these animals. This is particularly disadvantageous in the case of a slow-acting therapeutic agent like chaulmoogric acids; for our experience in the treatment of leprosy has shown that the chaulmoogric acids act very slowly, and that from one to two years' treatment is necessary to effect a cure. The life of a tuberculous guinea pig or rabbit is much less than this time, and is usually measured by one to a few months. Possibly the most that we can hope to accomplish under these conditions is to modify to some degree the course of the disease and obtain a consistent prolongation of life of the treated animals.

In these preliminary experiments, many factors have contributed to impair the results and preclude drawing definite conclusions. Too few animals were used in most of these experiments, and the number was still further reduced in many cases by deaths from intercurrent infections and by premature sacrifice of animals. Rabbits especially, when their resistance is lowered by tubercular infection and by inoculation treatment, are very susceptible to infection with *bacillus cuniculisepticus,* giving rise to pneumonia, empyema, etc., and this infection spreads from rabbit to rabbit if they are not kept in individual pens. Treated animals, that did not succumb to intercurrent infections and outlived the controls, were unfortunately sacrificed in many cases, either to determine the course of the disease or because it was believed that they had failed to become infected. In the earlier experiments, too large doses of tubercle bacilli were inoculated, which gave overwhelming infections that ran a too acute course for successful treatment. And, in the light of our knowledge of the slow therapeutic action of the chaulmoograte in leprosy, treatment of the animals in these experiments was not sufficiently intensive and prolonged to obtain maximum results.

The general method of conducting these experiments has been to infect a certain number of animals with a uniform quantity of a virulent strain of human tubercle bacilli, to treat half of the animals and reserve the other half as controls. Treatment was begun usually on the day of infection, because the life of a tuberculous guinea pig or rabbit is relatively so short and the possible therapeutic action of the chaulmoogrates probably so slow that otherwise no results could be expected, and because it was the purpose of these preliminary experiments to determine whether or not chaulmoogra oil or its derivatives were capable, under the most favorable conditions, of modifying to any appreciable degree the course of tuberculosis in the experimental animals. In a few experiments, however, one to four weeks intervened between the infection and treatment of the animals. The effect of treatment was estimated, after excluding animals that died from intercurrent infections or other accidents, by the average life of the treated as compared with that of the control animals and by the findings at necropsy. In the following table are given the essential data of these experiments.

From these preliminary experiments, owing to the small number of animals used and to various accidents that interrupted them, it would be unwise to draw any hard and fast conclusions; all that I am willing to say of them is that they are suggestive. They suggest, first, that chaulmoogra oil and its derivatives have some therapeutic action on experimental tuberculosis, which is partly masked by the slowness of this action and the relatively acute course of the disease in these animals. Although premature deaths from secondary infections and other causes reduced the number of the treated more than of the control animals, nevertheless the average length of life of the treated exceeded that of the control animals in ten out of the eleven experiments. Many of the treated animals which outlived the controls were killed in good condition and showed lesions that were apparently retrogressive or no lesions. These retrogressive lesions consisted of connective tissue containing little or no caseous material, and sometimes of empty connective tissue sacs. There is, of course, a temptation to regard the absence of tubercular lesions in some of these animals, in which treatment was begun immediately after infection, as due to a prophylactic action of the early treatment; but I doubt if such a conclusion would be warranted in so small a series of animals. It is noteworthy, however, that all of these animals without tubercular lesions fall in the treated groups. Secondly, these experiments indicate that, as in leprosy, the therapeutic action of chaulmoogra oil and such derivatives as have been used is slow in tuberculosis and that treatment must be continued a long time to obtain results. And, thirdly, it would appear, as is also observed in leprosy, that not all tubercular animals respond equally to the treatment. Some of the treated animals went steadily downward and died of tuberculosis at about the same time as the controls; others lived much longer than the controls, were killed in good condition, and showed apparently retrogressive lesions or no lesions. However, it is recognized

TABLE I

Treatment of Experimental Tuberculosis with Chaulmoogra Oil and its Derivatives.

EXPERIMENT NUMBER	ANIMALS	TREATMENT	FATE OF ANIMALS	NECROPSY FINDINGS	AVERAGE LENGTH OF LIFE IN DAYS
1	5 guinea pigs.	Heiser's mixture of chaulmoogra oil 1:75,000 to 1:10,000 of body weight, subcutaneous, at 3-5 day intervals.	Died.	T. B.	71
	5 guinea pigs.	Controls.	Died.	T. B.	58
2	5 guinea pigs.	Heiser's mixture of chaulmoogra oil, 1:20,000 to 1:5,000 of body weight, subcutaneous, at 5-7 day intervals.	Died.	T. B.	45
	5 guinea pigs.	Controls.	Died.	T. B.	36
3	3 guinea pigs.*	Heiser's mixture stained with Sudan III 1:25,000 to 1:15,000 of body weight, subcutaneous, at 4-7 day intervals.	2 died. 1 killed, 113th day.	T. B.	90+
	1 guinea pig.	Control.	Died.	T. B.	72
4	5 rabbits.	Sodium salts of chaulmoogric acids, 1:300,000 to 1:100,000 of body weight, intravenous, at 4-5 day intervals, 6 treatments only.	1 died of secondary infection, 49th day. 4 killed 134-145th day.	T. B. Empyema. T. B. 1 retrogressive? 3 progressive.	139+
	5 rabbits.	Controls.	2 died T. B. 3 killed 134-145th day.	T. B. All progessive.	99+
5	2 rabbits.	Sodium salts of chaulmoogric acids, 1:750,000 to 1:100,000 of body weight, intravenous, at 4-7 day intervals, 22 treatments.	Both killed 151st day.	Both negative	—
	1 rabbit.	Emulsified chaulmoogra oil, 1:750,000 to 1:100,000 of body weight, intravenous, at 4-7 day intervals, 22 treatments.	Killed 151st day.	T. B. A single focus (4-5 m.m.) in right lung, retrogressive?	—
	2 rabbits.	Controls.	Both killed 151st day.	T. B. progressive.	—

TABLE I — Continued

EXPERIMENT NUMBER	ANIMALS	TREATMENT	FATE OF ANIMALS	NECROPSY FINDINGS	AVERAGE LENGTH OF LIFE IN DAYS
6	3 rabbits.	Sodium salts of chaulmoogric acids, 1:500,000 to 1:100,000 of body weight at 3-7 day intervals, treatment started after one month.	1 died of secondary infection 4th day. 1 killed 140th day. 1 died 222nd day.	Empyema. T. B. progressive. T. B. retrogressive?	151+
	3 rabbits.	Controls.	Died.	T. B. progressive.	86
7	3 rabbits.	Sodium salts of chaulmoogric acids, 1:500,000 to 1:100,000 of body weight, intravenous, at 4-7 day intervals, 13-24 treatments.	1 died of secondary infection 13th day. 1 died of strangulation 71st day. 1 killed 168th day.	Empyema. T. B. retrogressive? T. B. retrogressive?	123+
	3 rabbits.	Controls.	1 died of secondary infection 5th day. 1 died T. B. 78th day. 1 killed 168th day.	Empyema. T. B. progressive. T. B. progressive.	119+
8	3 rabbits.	Sodium salts of chaulmoogric acids, 1:500,000 to 1:100,000 of body weight, treatment started after 7 days, at 7 day intervals 24-35 treatments.	1 became paralyzed and was killed 171st day. 2 died.	T. B. retrogressive? Both T. B. progressive.	231+
	3 rabbits.	Controls.	Died.	T. B. progressive.	256
9	3 rabbits.	Sodium salts of chaulmoogric acids, 1:500,000 to 1:100,000 of body weight, intravenous treatment started after 14 days, at 5-8 day intervals, 28-34 treatments.	1 died of secondary infection. 2 died of T. B.	Empyema and lung abscess. Both T. B. progressive.	234
	3 rabbits.	Controls.	1 died of secondary infection. 2 died of T. B.	Empyema and lung abscess. T. B. progressive.	148

TABLE I — Concluded

EXPERIMENT NUMBER	ANIMALS	TREATMENT	FATE OF ANIMALS	NECROPSY FINDINGS	AVERAGE LENGTH OF LIFE IN DAYS
10	3 rabbits.	Sodium salts of chaulmoogric acids, 1:500,000 to 1:100,000 of body weight, intravenous, at 2-7 day intervals, 22-32 treatments.	1 became paralyzed and was killed 95th day.	All T. B. retrogressive?	303+
			1 killed in good condition 369th day.		
			1 became paralyzed and was killed 446th day.		
	3 rabbits.	Controls.	1 died of secondary infection.	T. B. progressive.	207
			2 died of T. B.		
11	4 rabbits.	Ethyl chaulmoograte intramuscular, 0.01 cc.-0.1 cc., at 3-7 day intervals, 18-28 treatments.	2 became paralyzed and were killed.	T. B. progressive. negative.	165+
			2 died, 1 with abscess of thigh.	T. B. retrogressive?	
			1 died 15th day cause unknown,	T. B. progressive.	
	4 rabbits.	Ethyl chaulmoograte emulsion, intravenous, 1:500,000 to 1:100,000 of body weight, at 3-7 day intervals, 13-29 treatments.	1 died suddenly after injection, 72d day.	—	236+
			killed 203d day in good condition.	T. B. progressive.	
			1 still alive on 424th day.	T. B. retrogressive?	
	4 rabbits	Controls.	Died.	— —	
				T. B. progressive.	95

*This experiment was to study absorption of Heiser's mixture, stained with Sudan III.

that a more extended series of experiments may completely overturn these tentative conclusions.

III. WORK IN PROGRESS

The work now being undertaken on this problem may be discussed conveniently under three heads: (1) the preparation of derivatives of chaulmoogric acids; (2) biochemical studies of the absorption, distribution and fate of chaulmoogra oil and its derivatives in the animal body, and (3) therapeutic tests of the chaulmoogric acids and their derivatives on animals experimentally infected with tuberculosis.

The purpose of the synthetic work on the chaulmoogric acids is to obtain, if possible, a compound which will be more rapidly absorbed, will not be decomposed and stored in the tissues as glycerol esters or fat, will penetrate the tubercular lesions, and will have a more rapid and intensive therapeutic action than those hitherto used in leprosy. The preparation of

these derivatives is limited by the physical and chemical properties of these fatty acids, which render many of their compounds unsuitable for therapeutic use. Of the salts, only those of sodium and potassium are water soluble and suitable for intravenous injection. The esters of chaulmoogric acids, after vacuum distillation, are thin oily fluids suitable for intramuscular injection. These esters, containing alkyl radicles, are of considerable interest to us because of the superior therapeutic results obtained with one of them in leprosy, and on account of the observations of several investigators on the effect of alkyl radicles introduced into bactericidal compounds. It is well known that the introduction of an alkyl radicle into phenols, forming cresols, enhances the bactericidal properties of these compounds. Furthermore, Churchman (1913), Jacobs, Heidelberger and Bull (1916), Kleigler (1918), Crossley (1919) and Morgenroth and Kauffmann (1920) have shown that the bacteriostatic and bactericidal actions of other organic compounds are augmented by the introduction into them of alkyl radicles. Kleigler found that an increase in the number of alkyl radicles increased the bacteriostatic action and that the bacteriostatic action is enhanced to a greater degree by the ethyl than by the methyl radicle. Jacobs, Heidelberg and Bull concluded that in the hexamethylenetetramin compounds the bactericidal activity increased from the methyl to the ethyl to the propyl compound, that is, was proportional to the molecular weight of the introduced alkyl radicle. Morgenroth and Kauffmann, however, found in the hydrocupreine compounds that, while alkyl radicles caused an increased bactericidal action against pneumococci and that this increase varied with the different alkyl radicles, the variation did not strictly correspond to their molecular weights. Thus propylhydrocupreine was less active than ethylhydrocupreine, but isoamylhydrocupreine had a markedly increased bactericidal action. Because of the superior therapeutic results obtained in leprosy with the ethyl esters of chaulmoogric acids and the possible enhancing effect of certain higher alkyl radicles on bactericidal action, it has seemed especially desirable to prepare for therapeutic test the whole series of alaphatic esters and all of their isomers of chaulmoogric acids. Concerning the possibilities of the aromatic esters of chaulmoogric acids, nothing is known. It is of interest, however, that Macht, Satani and Swartz (1920) have shown that benzyl alcohol, even in considerable dilutions, has pronounced bactericidal properties; that Jacobson (1919) has found that benzyl alcohol has a high capacity to dissolve tubercle bacilli *in vitro;* that Jacobs, Heidelberg and Bull (1916) found the benzylethyl derivative of hexamethylenetetramin eminently bactericidal; and that many of the benzine derivatives possess germicidal properties or are capable of enhancing the germicidal properties of other substances with which they are combined. All of the above are examples of compounds, which we are preparing, having the introduced element or radicle attached to the side chain of the chaulmoogric ring. The introduction of elements or radicles into the ring of chaulmoogric acid offers almost unlimited possibilities of modfying the structure and possibly the therapeutic action of this acid.

The more important biochemical problems presented by this investigation are: (1) the absorption of chaulmoogra oil and its derivatives from the alimentary tract, the tissues and the blood; (2) do any of the derivatives of chaulmoogric acids, when inoculated into the blood or tissues, circulate in the blood unchanged? or (3) are the chaulmoogric acids, in whatever form and way they may be introduced into the animal body, combined with glycerol and stored in the tissues as fat? (4) are any of the derivatives of chaulmoogric acids able to penetrate the tubercular lesions and reach the tubercle bacilli? and (5) what is the ultimate fate of chaulmoogric acids in the animal body?

If chaulmoogra oil or its fatty acids are absorbed readily from the alimentary tract, it would seem that ingestion of them would be a convenient method of at least supplementing the injections to secure saturation of the body with the therapeutic agent. However, McDonald and Dean have decided that no better or more rapid therapeutic results are obtained in leprosy by supplementing the injections of ethyl esters by ingestion of the fatty acids, and the old method of administering the whole oil by mouth apparently gave therapeutic results in leprosy much inferior to the present method of intravenous or intramuscular injections of the salts or esters. Absorbed from the alimentary tract chaulmoogra oil, or its fatty acids, undoubtedly is stored in the tissues as glycerol esters, like other fats, and probably can circulate in the blood and reach the tubercular lesions, if at all, only when metabolized into phospholipoids such as lecethin. This would perhaps explain the slow action of chaulmoogra oil administered by mouth in leprosy, as it would probably be necessary to replace to a certain extent the normal fats of the body with glycerol esters of chaulmoogric acids before a sufficient amount of phospholipoids containing these fatty acids can be turned into the circulation to exercise a therapeutic action. If chaulmoogric acid compounds injected into the blood or tissues are invariably decomposed and stored as fat, then these derivatives and their method of administration would appear to have no advantage over the ingestion of the whole oil; but, if some of them circulate in the blood intact, the hope of discovering some derivative having a more rapid and intense therapeutic action would be well grounded. The fact that the sodium salts and ethyl esters intravenously or intramuscularly have given therapeutic results in leprosy much superior to the ingestion of the whole oil or its fatty acids lends support to this hope. Finally, the therapeutic agent must not only circulate in the blood, but it must be able to penetrate the tubercular lesions in order to exercise its bactericidal action. The penetration of tubercular lesions with their more or less extensive areas of necrotic tissue deprived of blood supply is probably quite a different matter from the penetration of leprous lesions, and may mean all the difference between success in the therapy of leprosy and failure in tuberculosis.

The animal experiments are being undertaken on a large scale; and every effort is made to correct the shortcomings of our preliminary experiments and to minimize the handicap of slow therapeutic action of

the chaulmoograte and short life of the experimental animals. These experiments are directed, first, to determine definitely whether or not chaulmoogric acids are capable of inhibiting or modifying the course of experimental tuberculosis. Our preliminary experiments, it is true, suggest that the chaulmoograte do have some therapeutic action, which is in part masked by the slowness of this action and the acute course of the disease in the experimental animal; but a larger series of carefully controlled experiments are necessary to establish the fact or fallacy of this impression. Secondly, these experiments are intended to test the relative therapeutic activity of the large series of derivaties of chaulmoogric acids, which we are preparing, with the hope of discovering one having more rapid and intensive action. Such comparative tests, even if they fail to demonstrate among our derivatives one of greatly superior therapeutic properties, may at least indicate the direction which further synthetic work should proceed to attain this end. Other important points to be determined by these animal experiments are the relative efficacy of administration of chaulmoogra derivatives by mouth, by intramuscular and by intravenous injections, dosage, toxicity, and prophylatic action.

It is hoped that the work now under way will, when completed, give us sufficient data from which to draw definite conclusions as to the therapeutic possibilities of chaulmoogra oil derivatives in tuberculosis; conclusions that will either preclude the necessity of more work on the problem, or will stimulate further investigation. Should we fail to attain the full measure of success hoped for in the therapy of tuberculosis, it will be a source of some satisfaction to all of us, I believe, to know that the information obtained in this investigation will be to a large extent applicable to leprosy and should contribute materially to the successful treatment of this disease.

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THE EFFECT OF ARTIFICIAL PNEUMOTHROAX ON THE COLLATERAL LUNG*

By Saling Simon, M.D.

Denver

Artificial pneumothorax has maintained a high place as a therapeutic procedure in pulmonary tuberculosis, having gradually but consistently gained in general favor since its inception about four decades ago. First used only by a few and in hopeless and advanced cases the procedure is now more widely employed in selected cases from all stages of the disease. The advent of the roentgen-ray, its application to chest diagnosis and in the administration of artificial pneumothorax has helped elucidate many otherwise vague findings and results. In former days, it was an axiom that pneumothorax should not be performed unless the collateral lung was uninvolved. Practical experience, however, soon showed the fallacy of this idea and the impossibility of finding the clear cut unilateral case. It is difficult to estimate the number of cases of pulmonary tuberculosis in which collapse therapy has materially harmed or made the disease progress on the treated side, the percentage varies with the individual experience, but the general concensus of opinion is that most cases are benefited. Even more difficult is it to determine the percentage of cases in which the collateral uncollapsed lung has been deterimentally affected by the treatment. Schill,[1] in an excellent recent communication, has aptly divided the opinions of the various observers on the latter phase of this subject and classifies them into three groups. So far as he was able to observe, however, no direct studies on this subject had been made. In the first group were included those observers who believed the pneumothorax exerted a harmful effect upon the collateral lung, the actual cases reported, however, included only a small percentage of the cases treated (15 to 12 per cent.); in the second group was included those who believed the pneumothorax exerted a beneficial effect upon the collateral lung, the cases reported in this group were also not numerous; while in the third group were included those who believed the pneumothorax had very little, if any, effect upon the collateral lung: this was by far the more prevalent opinion. In concluding, Schill notes that, in those cases reported as definitely harmed on the collateral side, the period of observation was extremely short; and that the cases were of the acute pneumonic and malignant types considered unsuitable for any treat-

* This paper, with illustrations, appears in the American Review of Tuberculosis for October, 1921.

ment and therefore worthless in so far as indicating any accurate estimate of the treatment. In suitable cases, and where the observations were extended, the artificial pneumothorax could exert a beneficial effect upon the collateral lung. He strongly recommends a prolonged period of observation before drawing conclusions.

TABLE 1

*Bilateral pleural manometric readings in goat before and after right sided artificial pneumothorax**

AMOUNT OF AIR INJECTED INTO THE RIGHT PLEURAL CAVITY	PLEURAL CAVITY	WATER MANOMETER READINGS IN CENTIMETRES IN INTERSPACE					
		First		Third		Fifth	
Before	Right	+0.0	−1.5	+0.0	−4.0	+0.0	−3.0
	Left	+0.0	−1.5	−1.0	−4.0	+0.0	−3.0
After 50 cc. on right side	Right	+4.0	−2.0	+0.5	−1.5	+4.0	−3.0
	Left	+2.0	−2.5	+3.0	−3.0	+4.0	−2.0
10 minutes after an additional 50 cc.	Right	+4.5	−2.0	+4.0	−1.0	+4.0	−3.0
	Left	+4.0	−3.0	+5.0	−3.0	+5.0	−3.0

* This experiment was duplicated in another goat with about the same general results.

In a purely anatomical study of the human chest in health and disease, Nitsch [2] describes two thin and flexible spots in the mediastinum which are especially prone to transmit an effect on the collateral lung following the application of an artificial pneumothorax. The one lies anteriorly directly behind the sternum at the site of the atrophied thymus gland, being variable in size, and the other lies posteriorly in the vicinity of the large vessels bounded by the spinal column and aorta behind and the esophagus and heart anteriorly. In order to determine the value of accurate manometric readings in artificial pneumothorax, Muralt [3] elaborately studied the effects of various conditions in the treated side of the chest upon the manometer. He found, that although pressure readings were susceptible to a great many individual influences, that in sum total the findings were fairly constant and could be analyzed into valuable information regarding the position of the needle; the condition of the pleural space; the condition of the mediastinum; the amount of gas resorbed and that necessary to maintain compression; the early diagnosis of an exudate; and the presence of a perforation of the lung or a valvular pneumothorax. He points out that it is necessary to make all comparative manometric readings in the same relative position since there is a distinct difference in pressure in the different interspaces, and anteriorly and posteriorly. The observations, to be reported in this paper, concern mainly a clinical and roentgenological study of a number of cases of pulmonary tuberculosis in which special attention was paid to the effect of artificial pneumothorax on the collateral lung. In order to gain an insight into the effect of artificial pneumothorax upon the col-

lateral lung from a physiological standpoint, manometric readings of both pleural cavities were made in man and goats.

THE EFFECT OF PNEUMOTHORAX UPON THE MANOMETRIC READING IN THE COLLATERAL PLEURAL SPACE

In order to determine the difference between the manometric readings at different intercostal levels, a normal goat was used and intrapleural manometer readings were made on both sides of the chest consecutively. During the entire period of experiment, the goat was kept under a uniform medium ether anesthesia. Readings were made at the first, third and fifth interspaces on both sides about mid-way between the sternum and spinal column, before and after the introduction of air into the right pleural cavity. The results of the manometric readings are given in Table 1.

Our study of the bilateral intrapleural pressure in man was limited to three cases, two that had previously had an artificial pneumothorax and one that was initially treated. The technique employed was identical to that used in the goat, care being taken to make all readings as nearly comparable as possible and introducing the needle at about the same level and in the same interspace on both sides. The readings were made with a water manometer, which connected to the two needles through a two-way cock so that the pressures on the two sides could be read consecutively and within a short time of each other. The needles used were also of medium calibre (18 gauge in man, and 14 gauge in goat) and the same for both sides to allow easy access to the manometer. Three cases were studied with the results given in Table 2.

THE EFFECT OF PNEUMOTHORAX UPON TUBERCULOSIS IN THE RABBIT'S LUNGS AFTER THE INTRAVENOUS INJECTION OF TUBERCLE BACILLI

In previous investigations reported from the Research Department of the National Jewish Hospital for Consumptives,[4] it had been found that one-sided artificial pneumothorax or compression of one of the lungs of the rabbit by means of fluid, artificial hydrothorax, has no visible macroscopic influence upon the number or type of the tuberculous lesions resulting from the intravenous injection of virulent human tubercle bacilli, regardless of whether the compression was occasioned on the right or left side; or whether it was occasioned a day before or a day after the intravenous injection of tubercle bacilli. There was noted no difference between the number or type of the tuberculous lesion in animals with one lung compressed as compared with normal animals, not compressed, although the difference between the different animals of the same series receiving the same intravenous injections of tubercle bacilli was greater than the differences found between the two lungs of the same animal. Prolonged artificial pneumothorax[5] in rabbits, sufficient

to induce a good collapse of the right lung, initated shortly after the intravenous injection of a suspension of virulent human tubercle bacilli and maintained for a period of a month by means of the intrapleural injection of air every second or third day throughout the experimental period, also had no appreciable effect upon the size or number of macroscopic tubercles found in the lungs of the treated animals as compared to the untreated, or in the compressed right lung as compared to the uncollapsed left lung. These experiments were conclusive, as far as they went, but it seemed desirable to study the effect of the pneumothorax upon a more advanced tuberculosis in elaboration of the above studies.

TABLE 2

The effect of artificial pneumothorax upon the collateral lung as indicated by the intrapleural pressure

CASE	SIDE OF PNEUMOTHORAX	TOTAL AMOUNT OF AIR INTRODUCED BEFORE READING WAS MADE	WATER MANOMETER READING IN CENTIMETRES				NOTES ON THE CASES
			Right pleural space*		Left pleural space		
		cc.					
1	Right (had 12 previous fillings begun 3 months before)	000	+0.0	−3.0	+0.5	−2.0	Male, 35 years. Pulmonary symptoms began 1½ years ago with spitting of blood. General condition good, slightly overweight. Physical examination reveals involvement of the right apex. Right pneumothorax begun 3 months before study. Sputum negative. Ambulant case.
		100	+0.0	−2.0	+0.5	−0.0	
		300	+0.5	−2.0	+0.5	−0.0	
		500	+0.5	−1.5	+0.5	−0.5	
		600	+1.0	−1.5	+0.5	−0.5	
		650	+1.0	−1.5	+0.5	−0.5	
2	Left (had 15 previous fillings begun 3½ months before)	000	+0.0	−1.0	+1.5	−0.5	Male 34 years. Hospital case. Cavity in upper left lobe, active advanced case, tubercle bacilli positive. Ambulant case at time of test. Left pneumothorax begun 5 months before study.
		100	+0.5	−0.5	+2.0	+0.5	
		150	+1.0	−0.5	+2.0	+0.0	
		200	+1.0	−0.5	+2.5	+0.5	
3	Left (initial filling)	00	−1.0	−3.0	−1.0	−3.0	Female, 24 years. Sanatorium case. Slight involvement of both apices with peribronchial thickening. Tubercle bacilli negative. Initial left pneumothorax begun with this study.
		50	−0.0	−2.0	−0.0	−2.5	
		100	−0.0	−2.0	+0.5	−1.5	
		200	−0.0	−2.0	+1.0	−1.5	
		250	+0.5	−1.0	+1.0	−1.0	

* During the making of manometer readings postural changes were carefully avoided, since it was found that these would materially affect the readings.

For this purpose, a series of 12 mature and healthy rabbits were given intravenous injections of a uniform suspension of virulent human tubercle bacilli, and after one month, when the tuberculosis had well developed, an artificial pneumothorax was instituted on the right side and maintained by intrapleural air injections at two or three day intervals for another three weeks, after which there remained four control rabbits untreated and three pneumothorax rabbits. Briefly stated, the results obtained did not differ from those obtained in the experiments previously reported. Prolonged artificial pneumothorax in rabbits, sufficient to induce a good collapse of the right lung, initiated one month after the intravenous injection of a suspension of virulent human tubercle bacilli and maintained for a period of three weeks by means of the intrapleural injection of air every second or third day had no appreciable effect upon the size or number of macroscopic tubercles found in the lungs of the treated animals as compared to the untreated, or in the compressed right lung as compared to the uncollapsed left lung.

THE EFFECT OF ARTIFICIAL PNEUMOTHORAX UPON THE CHEST ROENTGEN RAY FINDINGS

The animal experiments cited above would indicate that in so far as the macroscopic tuberculosis of the lungs is concerned the artificial pneumothorax treatment exerted no appreciable influence upon the disease in the two lungs at least within a short period of time. In spite of this, x-ray chest pictures taken in men treated with artificial pneumothorax would indicate early and rapid changes occasioned in the collateral lung. Unfortunately, x-ray chest studies in animals are beset with many difficulties so that this source is not available for a solution of this problem. It was for this reason that a series of chest plates in men were carefully studied in the hope of elucidating this apparent inconsistency between these results. The cases, of which there are seven presented, are given in three classes and in the following order; two in which the roentgenograph shows no appreciable or only a slight change; three in which the roentgenograph reveals apparent definitely increased pathological changes, and two in which the roentgenograph reveals apparently definitely diminished pathological changes in the collateral lung. A brief clinical record of the seven cases follows:

Case 1. No appreciable change in the roentgenograph of the collateral lung taken before and six days after a partial artificial pneumothorax on the left side. Female, age 45 years, housewife, entered the National Jewish Hospital for Consumptives with slight fever, night sweats, hemoptysis, chills and loss of weight. Upon admission, examination of the left lung revealed numerous moist räles after expiratory cough throughout its entirety, the resonance was impaired, a friction rub was heard and vocal fremitus was increased. Dry rales were found at the apex of the right lung, with increased vocal fremitus, and the rest of this lung was normal. Artificial pneumothorax was performed on the left

side November 4, 1920, and six days later, after two administrations of gas, a roentgenograph was taken which revealed partial compression of the left lung; but in comparing the roentgenograph of the right lung, before and six days after establishing the left artificial pneumothorax, there does not seem to be any appreciable difference between the density of the mottling at the end of this time.

Case 2. A slight increase in tissue density in the roentgenograph taken three months after a good left side artificial pneumothorax in comparison to that found in the collateral or right lung before pneumothorax. Male, 34 years, cigar dealer, entered the hospital July 13, 1920, with fever, hemoptysis, weakness, cough, expectoration, pain in the chest and night sweats. Physical examination revealed impaired resonance over both lungs with moist rales after expiratory cough, vocal fremitus increased over both apices and the breathing was bronchial in type. The upper left lobe contained a cavity. The sputum contained tubercle bacilli. Artificial pneumothorax was performed on the left side November 4, 1920, and maintained until discharge, May 7, 1921, when the patient was recorded as greatly improved. In comparing the roentgenographs taken before and three months after the initiation of artificial pneumothorax, the right or collateral lung seems to reveal a slight increase in density at the end of this time while the collapse attained was good.

Case 3. A definite increase in the tissue changes in the roentgenograph of the right (collateral) lung taken five months after a good left side artificial pneumothorax in comparison to that found in the same lung before pneumothorax. A male, age 37 years, a clerk admitted to the National Jewish Hospital for Consumptives, February 15, 1919, with cough, expectoration, fever and night sweats. Physical examination revealed extensive involvement of both lungs, with bronchovesicular breathing, impaired resonance and räles over the entire chest wall anteriorly and posteriorly. A large cavity was found in the left infraclavicular region. The sputum contained tubercle bacilli. Artificial pneumothorax was performed on the left side August 26, 1919, and on January 9, 1920, fluid was noticed on this side which persisted for several months and then disappeared. The patient was discharged June 14, 1920, improved. A comparison of the roentgenographs, taken before and five months after the initiation of artificial pneumothorax, revealed the right or collateral lung to be definitely more involved (increased tissue density) at the end of this time. The collapse attained was good.

Case 4. A definite increase in the tissue density in the roentgenograph of the left (or collateral) lung, taken nine days after a marked right side artificial pneumothorax, as compared to that found before this treatment. A male, age 30 years, a clerk admitted to the hospital, May 15, 1918, with cough of two years' duration, night sweats, fever, dyspnoea on exertion, and hemoptysis. Physical examination revealed involvement of the right lung anteriorly above the first rib and posteriorly from the

sixth dorsal spine up, with moist räles and bronchovesicular breathing. The sputum contained tubercle bacilli.

The x-ray report indicated far advanced pulmonary tuberculosis of the right lung, adhesions to the right diaphragm, the heart displaced to the right, and multiple cavity formation on the right side with scattered consolidated areas. In the left lung there is fibrosis in the lower lobe and areas of scattered consolidation. Artificial pneumothorax was performed on the right side December 2, 1918. The patient was discharged, greatly improved, November 6, 1919. A comparison of the roentgenographs, taken before and nine days after the initiation of artificial pneumothorax, revealed the left or collateral lung to be definitely more involved (increased in tissue densities) at the end of this time. The collapse attained was marked for the time interval.

Case 5. A definite increase in the lung density in the roentgenograph of the right collateral lung, taken one month after a good left side artificial pneumothorax, as compared to that found before this treatment. A male, age 19 years, a drug clerk, entered the hospital with hemoptysis, fever and cough on November 20, 1917. Physical examination revealed impaired resonance and bronchial breathing over the left apex and numerous fine räles over the left apex and from the fourth rib up anteriorly and the third dorsal spine up posteriorly on the left side. There was impaired resonance over the right apex, with bronchovesicular breathing and a few räles. Tubercle bacilli were found in the sputum. The x-ray report indicated a diffuse mottled involvement of both lungs. Artificial pneumothorax was preformed on the left side, January 29, 1918. A comparison of the roentgenograph taken, before and one month after the initiation of artificial pneumothorax, revealed the right or collateral lung to be definitely more involved (increased in lung density) at the end of this time. The collapse attained was good.

Case 6. A diminution in the lung density in the roentgenograph of the right collateral lung, taken nine months after a good left side artificial pneumothorax, as compared to that found before treatment. A male, age 27 years, a clerk, was readmitted to the hospital October 25, 1919. At this time there was dulness over both apices; the resonance was impaired anteriorly, bilaterally from the third rib up. A few dry räles were heard in the right apex and all over the entire left side anteriorly and posteriorly. The breath sounds were bronchovesicular over the right apex, bronchial over the left apex, and bronchovesicular over the entire left side. Fluoroscopy revealed a small cavity in the left upper lobe at the level of the first interspace. The sputum contained tubercle bacilli. Artificial pneumothorax was performed on the left side February 19, 1920, when a good collapse was attained. The patient was discharged very much improved and able to work March 30, 1921. A comparison of the roentgenographs, taken before and nine months after the initiation of artificial pneumothorax, revealed the right or collateral lung to be less involved (decrease in lung density) at the end of this time. The collapse at this time was fair.

TABLE 3

Summary and classification of the clinical cases of artificial pneumothorax according to the X-ray findings in the collateral lung

CASE	INTERVAL BETWEEN THE INITIAL ARTIFICIAL PNEUMOTHORAX AND THE LAST ROENTGENOGRAPH	GRADE OF COLLAPSE ATTAINED	EFFECT OF ARTIFICIAL PNEUMOTHORAX UPON THE ROENTGENOGRAPH OF THE COLLATERAL LUNG
1	6 days	+*	Not appreciable
2	3 months	++	Slightly increased lung density
3	5 months	++	Definitely increased lung density
4	9 days	+++	Definitely increased lung density
5	1 month	++	Definitely increased lung density
6	9 months	++	Diminished lung density
7	11 months	+++	Definitely diminished lung density

* The grade of collapse obtained is graded arbitrarily, but approximately from − = no collapse to +++, a complete and maximum clinical collapse of the treated lung.

Case 7. A definite diminution in the lung findings in the roentgenograph of the right collateral lung, eleven months after a marked left side artificial pneumothorax, as compared to that found before treatment. A male, age 32 years, a tailor, entered the hospital, December 31, 1918, with cough and hemoptysis. Physical examination revealed impaired resonance over the entire left lung, vocal fremitus being increased in the left upper lobe, and moist râles were heard after expiratory cough over the entire left lung. In the right lung there were a few scattered râles with some impairment of resonance in the upper lobe. The sputum contained tubercle bacilli. Artificial pneumothorax was performed on the left side May 26, 1919. The patient was discharged May 26, 1921, improved. A comparison of the roentgenographs, taken before and eleven months after the initiation of artificial pneumothorax, revealed the right or collateral lung to be definitely less involved (a decrease in the lung density) at the end of this time. The collapse, at this time, was good; there also being fluid in the left pleural cavity.

Although there are certain apparent difficulties, in comparing different roentgenographs, even from the same individual, it seems that this study has brought out a number of definite points which can best be seen by tabulating the above cases as is done in Table 3.

SUMMARY

A study of the tabulation of the seven cases of artificial pneumothorax in man reported above seems to bring out several important points.

1. That pulmonary roentgenographic findings in the collateral lung, after artificial pneumothorax in cases of pulmonary tuberculosis, may be definitely increased and in so short a time, within nine days, after this

treatment that they would not appear to be due to actual pathological changes.

2. That these increased roentgenographic findings, in the collateral lung, occurring shortly after the initiation of artificial pneumothorax, are probably due to the intensification of the already existing pathologic changes.

3. That the preliminary roentgenographic changes, seen in the collateral lung, are in some way dependent upon the pressure from the treated side exerted against the mediastinum.

4. That after prolonged treatment, with artificial pneumothorax, a diminution of roentgenographic findings may occur in the collateral lung, which would indicate a decreased pathologic change in the lungs of these cases.

5. That bilateral tuberculous involvement alone does not necessarily contraindicate the use of artificial pneumothorax.

I wish to acknowledge gratefully the material assistance received from Drs. H. J. Corper, O. B. Rensch and H. Gauss during the preparation of this paper.

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A CLINICAL STUDY OF GRANITE DUST INHALATION

By D. C. Jarvis, M.D.

Barre, Vt.

For some time it has been apparent that an interesting chest problem existed among granite cutters. During the years that have passed, cutters showing a chest lesion have been diagnosed in various ways, among the more common being chronic bronchitis, chronic pneumonia, fibroid phthisis, cirrhosis of the lung, asthma and tuberculosis. The last named has been the diagnosis most commonly used, and from the fact that it did not coincide with the accepted conceptions of tuberculosis, the qualifying phrase "stone cutter" was used, the diagnosis appearing then as "Stone Cutter's Tuberculosis," sometimes spoken of as "Stone Cutter's Consumption." Locally, the condition has existed so many years in cutters with an advanced exposure history that it was taken as a matter of course, and the general opinion existed that the disease was the inevitable result and, once contracted, little could be done in arresting it.

My own work is limited to eye, ear, nose and throat. It is most natural that a certain number of these cases seek relief for throat symptoms. Realizing that the clinical condition did not respond to the usual measures successful in cases of a supposedly similar type, my interest became aroused and an effort was started to gain a better understanding of these perplexing cases.

Barre, Vermont, is considered the largest granite city of the world, and the number of cutters range from 1240 to 2400, depending upon the production needs of the industry. In view of the foregoing facts, the opportunity for study was exceptional, so in 1917 a hospital transformer was purchased for office use, and a beginning made in the unraveling of this perplexing clinical condition. The accumulation of data was slow and the advent of the Nation Tuberculosis Association in the field during 1919 was welcome. Through its Committee on Mortality from Tuberculosis in the Dusty Trades, an investigation of the granite cutting industry was started because it was thought that the granite cutting industry, among all the dusty trades, would show the highest mortality from tuberculosis. The investigation was divided into three phases, namely: a statistical inquiry, a mechanical process inquiry and the medical examination. In the prosecution of the last-named, the writer wishes to acknowledge at this time his indebtedness to Dr. Edward

R. Baldwin for his advice and assistance, as it is under his guidance that the medical examinations have been carried on. Four times he has journeyed to Barre, when assistance was sorely needed, because there is much to be done before 1240 men will vote to appear for an examination, especially when they consider themselves well and in no need of medical attention. The granite cutters have shown a remarkable spirit of cooperation. They did not appear because of any illness, but came up for examination in routine order by a vote of their Union. Many of them had never had occasion to consult a physician before. They were all able to work and considered themselves in good health. In addition to the cutters working, other cutters have been examined and studied whose cutting days were over and who were suffering from the affection that most cutters eventually have.

NATURE OF REPORT

There are many points worthy of detailed discussion, but at this time only a survey of the general clinical picture will be considered, an effort being made to outline the clinical points, and their stages of development. Five hundred granite cutters have been examined, the examination including an occupational history, medical history to the time of examination, weight, height, temperature, pulse, respiration, blood pressure, present symptoms, detailed chest measurements, an inquiry into mode of living, food, ventilation, an examination of eyes, ears, nose and throat, chest, and a stereoscopic set of x-ray films of each cutter's chest. Sputum was taken when possible.

REVIEW OF THE LITERATURE

While numerous references are found in the literature to dust inhalation in general, and some forms in particular from Ramazzini's article in 1700 down to the present time, one fails to find a record of a definite study of the clinical manifestations of the inhalation of granite dust. The term "stone cutters" is found, but with no particular effort to separate granite cutters from marble workers and stone masons. The general report of the Miners' Phthisis Prevention Committee of South Africa, published under date of March 15, 1916, comes the nearest to the present work in Barre, but their similarity lies in the composition of the stone and not in the manner of handling it, as the South African process I understand to be a blasting one, while the Barre process is in finishing the stone for monumental purposes, the stone being worn down by means of a pneumatic tool. The work in Barre represents the first work of the Committee on Mortality from Tuberculosis in the Dusty Trades. The only other investigation of a dusty trade in this country is represented by the valuable contribution to be found in United States Bulletin No. 85, issued January, 1917, comprising a clinical study of 433 cases of Miner's

Consumption among zinc miners in Southwestern Missouri, by A. J. Lanza. In this study 150 miners were x-rayed.

EXPERIMENTAL PATHOLOGY

Dr. L. U. Gardner of the Saranac Laboratory is in charge of the experimental work and the reader is referred to his article in the December, 1920, number of THE AMERICAN REVIEW OF TUBERCULOSIS for the preliminary details of this phase of the work.

PRESENT PROBLEM

In 1915 we found in Barre 2050 granite cutters working, while four years later we find only 1240. In order to determine whether this state of affairs was peculiar to Barre the number of cutters in this country was investigated for the same period, and it was found that the condition in Barre held good for the entire country. The statistician returned the report that an analysis of the death certificates for the past twenty years in the Barre district indicated that 86 per cent. of the cutters died from tuberculosis. The present medical work was undertaken to assist in determining the incidence of tuberculosis among the living cutters.

Composition of Barre Granite

Silicon dioxide	69.56
Aluminum oxide	15.38
Iron oxide	2.65
Magnesia oxide	Trace
Calcium oxide	1.76
Sodium oxide	5.38
Potassium oxide	4.31
Maganese	Trace
Loss on ignition and moisture	1.02
	100.06

According to Gardner, "When examined under the microscope the unscreened dust may be roughly divided into large and small particles. The former, which could not possibly be concerned in an inhalation experiment, show an average size of 82 x 84 microns. The smaller particles average 4.3 x 6.3 microns with a minimum of .028 x 1.4 microns by actual measurement. In shape the particles may vary greatly; some are flattened polygonal masses with sharply horizontal or square cut ends. Frequent vegetable cells and fibers are noted." Samples of dust resulting from the use of the pneumatic tool have been examined by means of a small giant magnet made by the Victor Electric Company, and considerable steel extracted from a given quantity of granite dust by means of the magnet, two drams of granite dust yielding two grains of steel. From this experiment it will be seen that we are dealing with two kinds of dust, that

from the stone being worked, and that from the tool used in working it, giving rise not only to a silicosis but to a possible siderosis as well.

DIVISION OF THE CLINICAL PICTURE

As it was not possible to prove that granite cutters had tuberculosis in all cases, it was found necessary to accept the diagnosis of pneumoconiosis, and a continued study of the granite cutter's condition seems to bear out this diagnosis; but in working out the clinical picture, which originally was thought to include only the chest condition, we find that there are other factors to be considered, such as the gastro-intestinal tract and genito urinary system. The gastro-intestinal and genito urinary symptoms often precede the chest symptoms. It will be readily appreciated that in a study of granite dust inhalation one is observing a clinical manifestation whose pathological beginnings are slight and generalized, and as a result the onset of the conditions is insidious, requiring many years to develop. The very slowness of the process is an assistance when studying the clinical manifestations because the various stages do not merge so quickly that one is at a loss to arrange them in their right order. In the earlier observations it was thought that the chest condition was the only one, there being a direct connection between the chest condition and the amount of dust inhalation, but a continued study of the subject discloses the fact that there are other factors governing the chest lesion. Advising a cutter to remain away from work without other treatment generally results in improvement, but it is very slow and a matter of months, while treatment directed to his gastro-intestinal tract, allowing him still to continue cutting granite, will result in his gaining weight, losing his cough and expectoration, the diminution of his dyspnea and the relief of his occasional pleuritic pains.

Gastro-Intestinal Symptoms. Since all this happens while the patient is still continuing work it leads us to believe that the gastro-intestinal tract is a factor in the production of chest symptoms. Ten years seem to elapse before the cutter presents himself at the physician's office for the relief of gastro-intestinal symptoms. Between ten and fifteen years are necessary before his genito urinary symptoms appear and generally between twenty and thirty years must elapse in his occupational life before his chest symptoms appear. His gastro-intestinal symptoms are as follows: He loses his zest for food although still able to consume his usual amount. In the morning following breakfast he is troubled by eructations of gas, accompanied by the appearance of food in the mouth. If he expectorates the food which appears in his mouth he will practically, by the repeated eructations of gas and food, have lost half of his breakfast by the time he has reached the granite shed and started work. It has been observed if the cutter moves about following his evening meal that he is less troubled by this (morning) eructation of food and gas, than if he remains quiet during the evening. This eructation of gas is common during the day and he is conscious of an abdominal distension which makes it difficult for

him to give his shoes the usual attention if bending over is indulged in. The gastro-intestinal condition does not seem to be influenced by changing the cutter's diet but seems to depend rather on the taking of food in itself. There seems to be no loss of food following the midday or evening meal.

Genito Urinary Symptoms. The cutter's genito urinary symptoms are as follows: His chief complaint is the necessity of arising during the night to urinate; twice being the usual number of times he finds it necessary to arise; the quantity of urine passed not being large but the desire to urinate being urgent. With this he complains of sacral backache and feels that he needs a tonic, as he is more tired during the day than formerly. In the presence of a urine frankly acid he may have a severe irritation of the genito urinary tract, accompained by a catarrhal discharge, causing one to be suspicious of a specific infection until the laboratory report proves otherwise.

Pneumoconiosis. A clinical classification being more or less imperative for a study of the chest lesion, the following was finally decided upon: Granite pneumoconiosis, granite fibroid pneumoconiosis, granite tuberculous pneumoconiosis. It seems advisable to use the term pneumoconiosis, as the two Greek words from which it is derived signify lung dust, which really represents the condition being studied, while the term phthisis is apt to convey as many meanings as it has pronunciations. While the term silicosis has been used it seems advisable in the interest of efficiency to use the term pneumoconiosis, and in connection with it the qualifying adjective granite as the term granite pneumoconiosis suggests at once the nature of the lung lesion under consideration, the manufacturing process, the percentage of silicon dioxide in the dust, and the type of workman. The second classification, granite fibroid pneumoconiosis, suggests not only the nature of the lung lesion and the industry in which it occurs, but also the progress which the lesion has made. The third classification, granite tuberculous pneumoconiosis, suggests the causative factor in producing the original lung lesion, the industry responsible for the lesion and the fact that tuberculosis has been superimposed upon pneumoconiosis. The chest lesion appears to be one most often seen and directly linked up with the cutter's occupation.

LOCALIZING SYMPTOMS

Dyspnea. The outstanding feature in the granite cutter is dyspnea, it becoming the cardinal symptom of first importance. All through his cutting days it is present in varying amounts, the time of its initial appearance seeming to depend upon the original expansion of the cutter's chest. In a cutter with an expansion of five inches the dyspnea would appear in proportion to the reserve expansion he is able to bring from time to time to his aid. It is most noticed by the cutter at the end of his working day, and at any time the occasion arises calling into play extra muscular exertion. Some idea of the extent of its existence may be gained by asking the cutter to hold his breath while listening to the heart, or some other portion

of the chest. This symptom continues to increase as the exposure years increase until finally it is present on rest. The cutter's death is generally one of sudden failure of the right side of the heart, or, if the final illness extends over any period of time, he suffers from intense dyspnea, the head being thrown back, and he motions for anything he wishes, not even taking the time to talk, the need of air being so great.

Cough. Owing to the adaptation of the respiratory tract to occupation, cough is not an early symptom. One gains an idea of this adaptation to occupation by drawing a throat swab across the posterior pharyngeal wall, or by holding a throat mirror against the soft palate. Neither is felt by the cutter, and he does not know of the presence of the throat mirror in his throat. The ordinary gargles are tasteless to him and it is only by using them very hot that results are obtained. When cough does appear it is in the latter stages and is at first a cough of irritation. It seems to be noticed most by the cutter when changing from indoors to outdoors, or when conditions are reversed. During the present investigation particular notice was taken in observing whether the men coughed while preparing for the x-ray examination, and it could not but be noticed that there was an almost complete absence of coughing. The cough when studied is found to be one of small amplitude. The cutter by reason of the position of his chest, which seems to be that of partial inspiration, is unable to increase intrapulmonic pressure to any degree. This inability may best be studied by observing the contraction of the muscle system which governs the amount of pressure made upon the lungs by the ribs. This system of muscles does not seem to contract as expected when increased intrapulmonic pressure is desired.

Expectoration. The cough just referred to, at first without expectoration, is later accompanied by it. At first not very profuse, it later increases in amount. For a time it will be free from tubercle bacilli, and in many cases remains so always. In event of the occurrence of tubercle bacilli in the sputum it does not seem to influence the clinical picture, as there seems to be no corresponding temperature curve, no night sweats, no hemorrhage, nor appearance of added physical signs. While the laboratory report may show few, moderate, or numerous tubercle bacilli, the primary disease, granite pneumoconiosis, seems to govern the clinical picture to the end, the tubercle bacilli representing a complication but not a factor of far-reaching influence. The appearance of bacilli in the sputum has locally at Barre, in the case of a granite cutter, served for years as a basis for the diagnosis of tuberculosis, and this has been the most common term used when filling out the death certificates. A continued observation of these cases forces one to conclude that they should be considered as tubercle bacilli carriers in the same manner as we have typhoid or diptheria carriers, as the advent of bacilli in the sputum does not seem to alter the clinical picture, nor accelerate the death of the cutter. Clincally, one is unable to differentiate between cutters with a positive sputum and cutters with a negative sputum. Two cutters under hospital care where four hour temperature readings could be recorded were observed. One

cutter had repeated negative reports on results of sputum examination and the other positive reports. Neither ran a fever and the cases apparently paralleled one another. It is felt that the advent of tubercle bacilli in the sputum should be made the occasion for the use of the term granite tuberculous pneumoconiosis, the adjective "tuberculous" conveying the change in the status of the case, this term assisting in classification of cases, but the advent of the bacilli having little or no influence upon the picture. One sees at times cutters with apparent moisture in the chest but unable to raise the same because of the inability to increase intrapulmonic pressure. In regard to the moisture in the cutter's chest, it has been felt that as a foreign body in the conjunctival sac produces a flow of tears in proportion to the irritation the dust produces, moisture in the cutter's chest is produced in proportion to the irritation produced by the dust previously inhaled acting as a foreign body. The moisture is apparently nature's effort to furnish a vehicle for the removal of the irritant as she furnishes it for the removal of the foreign body in the conjunctival sac.

Hemoptysis. This symptom does not seem to be common. Streaked sputum may occur and in the later stages there may be frank hemorrhage.

Pleurisy. Wet pleurisy seems to be rare, but dry pleurisy is common, the cutter being troubled frequently by flitting pleuritic pains. The dry pleurisy seems to be most evident in patches in the auxillary region.

Night Sweats. There seems to be an absence of night sweats.

Loss of Weight. One noticeable feature about the granite cutter is that he maintains his weight although the x-ray shows a profusion of densities. His color remains good; in fact, how many times it has been remarked on reading of a cutter's death, "He was looking so well it does not seem possible he is dead." It cannot but be noticed that in cutters who survive the twenty-five year exposure period the matter of weight seems to be associated somewhat with the presence of a positive sputum, as cutters having a negative sputum seem to maintain their weight in the face of considerable dyspnea, while cutters with a positive sputum are annoyed by the intense dyspnea and loss of weight. Whether the loss of weight comes from the worry induced by the knowledge of a positive sputum needs to be the subject of further investigation.

Loss of Strength. This is more or less in the background, the dyspnea usually being the reason for giving up work.

Temperature Range. In the men examined this ran from 97, the lowest, to 99.3, the highest, this latter temperature being present in only one cutter. The usual temperature was 98. It has been noticed that when a cutter contracted a febrile disease his temperature remained higher longer than would be expected, and he was less affected by the means usually employed in reducing fever.

Pulse Range. The usual pulse rate for a cutter lies between 68 and 72, but may run as low as 62 and as high as 96. When examining men representing ten different nationalities it is a question whether the psychic element does not enter into the examination when one office visit is all that is recorded in the way of pulse.

Physical Signs. In the earlier stages of the dyspnea nothing abnormal is elicited by means of physical examination, but as the disease progresses there appear certain signs that may be associated with granite pneumoconiosis.

Inspection. Too much cannot be said of inspection when examining a patient whose occupational history points towards pneumoconiosis, for on it one depends for much of his information. As one examines hundreds of cutters representing varying degrees of exposure, it is brought home to him that the chest type is governed to a large extent by chest contents. In cutters the chest types have been designated under three headings: hypotension, normal tension and hypertension. With the passing of exposure years the cutter's chest passes from normal to hypertension, and the anterior measurement of the chest as ascertained by the caliper increases from one-half to one inch. With this increase of anterior-posterior measurement the chest assumes a state of partial inspiration with absence of supra-sternal, supra and infra-clavicular retraction. The clavicles are horizontal, and the shoulders well thrown back with both scapulæ flat. This type of chest obtains until the number of exposure years reaches thirty, when one notices that while the hypertension type is maintained there is a change in the position of the shoulders, which come forward, and an abduction of one or both scapula takes place. In addition we have supra-sternal and supra-clavicular retraction on one or both sides. This inspection of the chest seems to be important, for from it we gain an idea of the pathological changes occurring within. The greatest amount of dust deposited in the lungs of a granite cutter occurs in the upper third, the left being affected to a greater degree than the right. The retraction of the supra-clavicular or infra-clavicular regions gives evidence of internal changes. The change in position of the shoulders seems to be accounted for by changes within the chest, there being adhesions to the chest wall in the upper third of the lung. Flitting pleuritic pains are caused by change in position of the chest wall; the pectoralis minor muscle endeavors to decrease its tension with the result that the shoulder comes forward and the trapezius muscle is made correspondingly tense. If the cutter is asked to take a deep breath it will be noticed that the inspiratory wave travels up the chest wall until it reaches the region of the nipples, when the whole chest wall then raises en masse and the deep inspiration is completed by the lower portion of the chest swelling out like a pouter pigeon.

Measuration. Having inspected the chest, several facts may be gained by the use of the tape, for it has been observed that as the years of exposure increase the chest expansion decreases until the point is reached where it does not move at all. Measuring each half of the thorax is of importance as it indicates to some extent the pathological changes within. There is a difference in the two sides from one-half to one inch and this difference is not thought to be occupational because it occurs only in the oldest cutters.

Palpation. As one would expect from the unequal expansion, one observes changes in various positions of vocal fremitus, but more so in cutters with advanced exposure histories.

Percussion. Patches of dullness will be discovered that will be explainable when the assistance of the roentgenologist is sought. These patches are most commonly found just below the clavicle and in the axillary region and seem to coincide with the areas of pleural involvement witnessed by increased density on the x-ray film in this region.

Auscultation. The stethoscope seems to represent the less important part of the physical examination because, owing to the number of dense pleuritic adhesions, the fibroid changes in the lung, and the diminished air intake, one feels that the handicap is too great to overcome when using the stethoscope for patients who by their physical appearance should show signs and do not. One is unable to elicit any different signs in the cutter who has a positive sputum than in the chest of the cutter having a negative sputum. Cavities may exist and give no evidence.

X-Ray. In the use of the x-ray the clinician finds his greatest assistance. The densities present will be all out of proportion to the clinical symptoms, and if the cases were to be diagnosed on the basis of the x-ray alone the results would be misleading. It is highly important that the clinician and the roentgenologist work together in this class of cases, the clinician furnishing full clinical data, including an occupational history of the patient, and the roentgenologist by means of the film densities explaining the symptoms, and upon learning the causal factor of the densities, whether it be bacterial, mechanical, or chemical, assisting the clinician in determining whether his patient should seek another industry.

SUMMARY OF FINDINGS

While studying the data from a statistical standpoint, in order that personal impressions be founded upon a statistical basis, the following ratios were revealed.

1. As the pulse rate goes down the respiratory rate goes up.

2. As the number of exposure years increase the chest expansion decreases.

3. As the fibrosis, when studied by means of the x-ray, increases the blood pressure decreases, so that one working more or less constantly among granite cutters may roughly estimate the amount of pulmonary fibrosis by observation of the blood pressure.

4. Cough with increased blood pressure accompanies respiratory irritation and calls for absence from work. Cough with decreased blood pressure accompanies fibrosis and does not demand absence from work, but rather attention to the gastro-intestinal tract.

5. There seems to be a relation between the number of childhood diseases the cutter has had and the rate of progress and date of onset of his chest condition. The greater number of diseases of childhood he has had, the sooner will he be affected by his occupation.

6. In studying nationalities, it is found that the more greasy the diet the better the prognosis as to freedom from occupational disease in the granite industry.

An effort has been made to state the evidence gained from a preliminary study of data secured by examining 500 granite cutters. Each one of you reading this will probably correlate it with your own previous experience and probably draw your own conclusions.

DISCUSSION ON PAPER BY DR. JARVIS

Dr. E. R. Baldwin, Saranac Lake: I think Dr. Jarvis ought to have introduced himself before he introduced his paper, but inasmuch as he did not, I think it becomes me to do so, and to explain that this study is participated in by the National Tuberculosis Association through a committee known as the Committee on the Mortality from Tuberculosis in the Dusty Trades. This committee was appointed about two or three years ago at the suggestion of Dr. Frederick L. Hoffman, who, as chairman, did a very extensive piece of statistical work through one of his assistants in the city of Barre, Vt., the city of the largest granite industry in the United States.

In order to explain further, I might say that we discovered Dr. Jarvis as a local nose and throat specialist who had also some local reputation as an x-ray specialist, but was doing the x-ray work merely because he found it necessary in his home field of practice. Therefore, we seized on Dr. Jarvis to do this x-ray work. We found him eager to take it up, and he has been of incalculable help to this committee. We also staged a number of clinics at which physical examinations were made by a number of men from the outside who had experience with tuberculosis, Dr. Rogers of the Vermont State Sanatorium, Dr. Bartlett of the Framingham Demonstration, and Dr. Ladd, the State Tuberculosis Examiner for the State of Vermont. All of these gentlemen made physical examinations which we have been trying to correlate with the x-ray examinations for a report.

I merely state now that a report will be made later of the medical work of this committee, which will be in detail. Meanwhile, a report has been made recommending that the granite industry generally shall give close attention to dust-removing devices, shall have a physical and radiographic examination of all men who enter the industry and all men doing their work in the industry. There are a great many other aspects of this problem which have come out of the work of Dr. Jarvis and his colleagues in the city of Barre who have assisted in the physical examinations, which are of extreme interest in the general problems of etiology in tuberculosis, and we are to be congratulated on having so much help from the local men, and especially Dr. Jarvis, who has undertaken this work.

Dr. H. R. M. Landis, Philadelphia: I should like to add my testimony to what Dr. Baldwin already has said of the excellent piece of work that Dr. Jarvis has done. I know of no field in which it is so necessary to make studies of this kind. My own personal experience with pneumo-

coniosis has been largely the type encountered among potters. I find in talking to Dr. Jarvis, and through correspondence we have had in the last two years, that there is a certain similarity between the granite workers and potters, with the exception that the potter takes a somewhat longer time to develop pathological changes. Both of them, when they have tuberculosis grafted on the pneumoconiosis, pursue, as a rule, a latent course.

It was not until the introduction of the x-ray that we got any clear picture of what the dust did. A potter may be exposed to the dust for a matter of fifteen or eighteen years without marked change, as far as physical signs are concerned. In the secondary stage, so-called, you have no abnormal physical signs whatever. When the advanced stage is reached, it is almost impossible to distinguish those cases from an advanced case of pulmonary tuberculosis, and in many of them, even with the x-ray, it is difficult to tell whether tuberculosis has been added to the picture. The only way a diagnosis can be made under those conditions is by the presence or absence of tubercle bacilli in the sputum.

Another thing that interested Dr. Pancoast and me in our study of these dust conditions was the extraordinary distorting effect that occurred to the diaphragm. The diaphragm is often fixed, rigid and distorted. The fixation of the diaphragm, plus the enormous amount of fibrosis in the lung, is the explanation for the extraordinary amount of dyspnea from which the patients suffer.

The only form of pneumoconiosis in which tuberculosis has a tendency to become very active, and more or less acute, is that form of pneumoconiosis which is the result of the inhalation of pure silica such as occurs in South Africa, in zinc miners in Missouri, and copper miners in Montana.

The silica is such a severe irritant that it sets up an acute inflammatory condition, and that makes the lungs more than ordinarily susceptible to tuberculosis. Furthermore, silicosis does not hold the tuberculosis in check as do the chronic forms of pneumoconiosis.

Dr. E. O. Otis, Boston, Mass.: I wish to emphasize the point that here is a large industry which exists in several of the New England States, in New Hampshire, Maine, and in Vermont, where Dr. Jarvis made his investigations, and that this industry at the present time, as Dr. Jarvis has shown us, is robbing its men of a third of their normal life. The great economic value of this investigation, it seems to me, is in leading to some method by which the men may be protected from this untimely death, and I think Dr. Jarvis has already devised a method which he hopes will be effectual in counteracting the present evils of the industry.

THE RESULTS OF AN EXPERIMENTAL STUDY OF THE DIETARY REQUIREMENTS IN TUBERCULOSIS*

By William S. McCann, M.D.

New York

In approaching the problem of the dietary requirements in a disease like tuberculosis it is necessary to possess certain fundamental facts for its solution. One should know first of all how much energy a patient with tuberculosis expends; next, what amounts and proportions of various foodstuffs are required to maintain a balance between intake and outgo of such important elements as nitrogen, phosphorus, sulphur, calcium and magnesium; and finally, especially in tuberculosis, one should know what effect the various foodstuffs have upon the respiratory exchange. It is also desirable to have a knowledge of the amounts of the so-called "vitamines" which are required in tuberculosis, but at the present time such quantitative studies are impossible.

The energy expenditure of tuberculous individuals was determined by obtaining the basal metabolism at various levels of body temperature. It was found that during afebrile periods there was practically normal heat production. As the body temperature rose there was found to be a variable increase in metabolism, which in general amounted to 30 per cent. with a temperature of 104 degrees. Since, in most febrile patients, the temperature undergoes marked diurnal variations, it is elevated approximately one half the time. Hence in estimating the 24 hour energy expenditure, an addition of 15 per cent. to the theoretical normal estimate will in most cases cover the increment due to fever. From the data of 23 cases of active tuberculosis studied, the 24 hour basal heat production varied from 1350 to 2030 calories. If for each patient 15 per cent. were added for an afternoon temperature of 104 degrees, and 5 per cent. added for coughing, and another 10 per cent. added for the specific dynamic effect of food, the energy required would range from 1760 to 2640 calories per diem, if the patient remained at absolute rest in bed.

Just as patients may be compared with normals on the basis of the minimal energy transformation or basal metabolism, so they may be compared on the basis of the minimal nitrogen excretion which may be attained by reducing the nitrogen intake to a very low level.

* From the Russell Sage Institute of Pathology, in affiliation with the Second Medical (Cornell) Division of Bellevue Hospital, New York.

In the tuberculous cases, it was found the nitrogen excretion could be reduced, in this manner, to a level almost as low as that of normal individuals. This was taken to indicate that in tuberculosis there were only small increases in the amount of protein destroyed. It was also determined that nitrogen balance could be established at a much lower level than had been supposed, — in a few cases as low as 37.5 grams of protein daily, by the addition of 500 to 900 calories to the basal fasting heat production. Such facts, however, do not indicate that the minimal level of protein metabolism is necessarily the optimum.

One of the most important factors to be considered in deciding what is the optimum amount of protein in the diet of pulmonary tuberculosis cases is the effect of the various foodstuffs on the pulmonary ventilation. It was assumed on *a priori* grounds that the increase in heat production, due to the specific dynamic action of foods, would necessarily be accompained by an increase in ventilation. Actual measurements of the amount of air breathed were made before and after the ingestion of the various foodstuffs. One finds that the ingestion of 70 grams of protein increases both metabolism and ventilation about 20-25 per cent. If this amount of protein, however, be divided into three meals, the ventilation and metabolism will not be appreciably increased. Some writers on the subject of diet in tuberculosis, notably Bardswell, have advocated as much as 150 grams of protein per diem, which, if divided into three meals, would be sufficient to cause a considerable increase in ventilation. Following the ingestion of fat, the rise in heat production and ventilation is much less for isodynamic quantities than it is for protein. The effect of carbohydrates upon the heat production is the least of all. However, in our experiments, it developed that although the metabolism may be but slightly increased, the relatively greater quantities of carbon dioxide eliminated during carbohydrate oxidation, cause a greater pulmonary ventilation. Following the ingestion of 100 grams of glucose the ventilation was increased 18 per cent., though the heat production was constant. Thus it appears that the greatest amount of energy may be obtained with the least effect on the respiration by the ingestion of fats.

It is well to recall that in certain other conditions R. G. Pearce has demonstrated the general validity of the assumption, not only that the pulmonary ventilation varies directly with the metabolism of the individual, but that the circulation rate varies in a similar manner. In view of this, these observations of the effects of food ingestion become doubly significant in pulmonary cases with hemorrhage.

Finally, you are all familiar with the effect of exercise on the temperature of an incompletely arrested tuberculosis of the lungs. It is at least a plausible assumption that the temperature reaction follows the destructive effects of increased respiratory activity on newly formed tissue barriers and on the increased circulation through the lesions. One might ask, therefore, whether the ingestion of large amounts of food could be shown to produce similar effects.

We have made some attempts to study the effects of "forced feeding." The first individual studied was an extremely advanced case. The functional lung capacity was very small. The patient had been comfortable and afebrile on a diet furnishing 2500 calories and 37 grams of protein. An attempt to increase the total calories and to raise the protein intake to 90 grams resulted in fever, marked increase in respiration, and on the second day all food was vomited. The vomiting continued. The food intake became less than 1000 calories, and death ensued on the fourth day. Attempts to force feeding in two other patients resulted in uncontrollable digestive disturbances.

In two individuals only was it possible to increase the diet to 4000 calories and 125 grams of protein. In these two individuals results directly comparable to the effects of exercise were not obtained. However, the following observations were made: that the pulse rate was elevated more after the forced feeding, and that after some days in both cases an increase in afternoon temperature was observed. In both cases physical signs indicated rapid progress of the lesions in spite of gain in weight and improved nutritional condition.

Studies have been made, also, of the balance between intake and excretion of certain mineral substances. These are very difficult to translate into the terms of practice, because the inorganic metabolism is so poorly understood. It seems fairly clear from our results and those of others, that the calcium intake needs to be greater in tuberculous than in normal individuals in order to maintain balance. Mendel has shown that the calcium of milk is more readily available than the calcium of most other foods, especially vegetable foods. For this reason it would seem that milk should be the chief source of protein for the patient, since relatively low protein diets from other sources would be deficient in calcium.

From our studies we are led to believe, therefore, that for most patients of average size at rest in bed, the best results will be obtained if the total calories of the food do not exceed 2500 to 2750 per diem, and that the protein should not exceed 70 grams, the chief source of which should be milk. It is preferable that such a diet be divided into four or five meals. In so far as the patient's digestive mechanism will permit, the non-protein part of the diet should be obtained from fat.

I would like to add, also, that none of these conclusions which we have reached should be applied without further study to the nutrition of tuberculous children. The whole question of normal metabolism of children is still very much unsettled, just as is the question of x-ray findings, and until that has been settled I think we should reserve judgment as to the diet.

DISCUSSION ON PAPER BY DR. McCANN

Dr. J. Alexander Miller, New York: I think we appreciate these studies of Dr. McCann. We have followed his previous communications

and those of Dr. DuBois, and it is with our realization, from clinical experience, of the extreme importance of proper understanding of diet in various conditions which arise in pulmonary tuberculosis, that I think we all welcome the beginning of a knowledge on a real scientific basis. I think that we can expect, as we go along, to receive more information from Dr. McCann's experiments, and also to see the application in the treatment of tuberculosis in various institutions, where necessarily the accurate scientific investigations, with the need of apparatus which Dr. McCann has at his disposal, would not be available.

The whole subject, of course, is one which vitally affects our treatment of tuberculosis, and I think it is in general line with the fault of diet that, certainly taking people at rest in bed (the basis of Dr. McCann's contention), forced feeding often does harm and may materially affect the ultimate results, as far as the improvement of our patients is concerned.

I only want to say in closing that I know that those of you who are particularly interested in this work would find it of very great value to see Dr. McCann and Dr. DuBois at Bellevue, and see how they are doing some of these metabolic studies, and you would get more of real value than can be compressed into this short paper of Dr. McCann's.

Dr. S. A. Knopf, New York: Just one more word about overfeeding the tuberculous patient. The tendency to do this has not entirely disappeared. While, as the speaker says, milk is a very valuable food for the tuberculous even the milk feeding can be overdone. I hope the committee to whose report we have been privileged to listen, will continue its labors and at our next meeting tell us something about how much milk may be given and what is the best substitute in case the milk is not borne well by the patient. With the exception of very rase cases, overfeeding should be discarded and the advanced tuberculous patient particularly should not be subjected to the distressing stuffing. This class of patients need rest in bed more than overfeeding, careful symptomatic treatment, suitable physical and mental environments, and careful supervision.

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THE CLINIC FOR NEGROES AT THE HENRY PHIPPS INSTITUTE

By H. R. M. Landis, M.D.

Philadelphia

In the earlier period of the Phipps Institute's work, it was found impossible to do satisfactory work with the Negroes. Those who came to the clinic, more or less by accident, could seldom be induced to persist in their attendance, and no considerable progress could be made with them as individuals. Moreover, the educational effort, which at the time served to bring increasing numbers of whites to the clinic, had no perceptible influence in increasing the interest of the colored people in their health.

It seemed likely that this situation could be changed by adopting the principle of operating through the medium of selected colored workers. The Whittier Center, an agency which had long worked for the welfare of the Negroes, was induced to employ a colored nurse to work as a member of the staff of the Institute. Mrs. Tyler was engaged in 1914. She was taught the methods employed by the white field nurses and instructed to go among the colored people and induce any with whom she might make contact to come to the clinic, in so far as there was reason to think that they might be suffering from lung trouble.

Mrs. Tyler's work, from the beginning, had an appreciable influence. Alone it did not seem to offer a complete solution of the difficulty. The situation was again greatly improved when a capable colored physician, Dr. Minton, became associated with the clinic, in 1915.

Dr. Minton's work has been of high quality, and after several years there is no reason to feel that, allowing for the matter of intelligence (and in this the Negro does not suffer particularly when compared with the white patients of the dispensary), work with the Negroes is in any way less successful than with the whites.

In the interval, the nursing service has been supplied in various ways. The Whittier Center continued for some years to support a worker. Later, the Pennsylvania Tuberculosis Society supplied one. Later still, the Philadelphia Health Council has supplied one. At times there have been two nurses on the service, at other times only one. The past service of Mrs. Tyler has been mentioned. Miss Turner was also associated with this clinic at one time. At present the organization of the Negro Clinic is as follows:

Dr. Landis in charge — Paid by the Phipps Institute and by the Department of Health of the State of Pennsylvania.

Dr. Henry Minton (colored), since 1915 — Paid by the State Department of Health.

Dr. Frank Boston (colored), 1921 — Paid by the State Department of Health.

Dr. G. A. Saunders (colored), 1921 — Paid by the State Department of Health.

Miss Johnson (colored), since 1915 — Field nurse, paid by the Philadelphia Health Council.

Miss Ernst (colored), since Nov., 1920 — Field nurse, paid by Whittier Center.

Treatment for syphilis, whenever encountered, is also afforded by Dr. Baird Stuart of the Phipps Institute staff.

The work of the clinic for 1920 is summarized as follows:

MISS JOHNSON'S YEARLY REPORT

New patients		266
Unfinished cases	37	
Positive tuberculosis	116	
Positive and Luetic	4	
Non-tuberculosis	52	
Non-tuberculosis and Luetic	22	
Indefinite	25	
Indefinite and Luetic	10	
Patients' visits to the dispensary		2099
Patients sent to hospitals		34
Patients referred to sanatorium		12
Cases closed		69
Death	19	
Moved	20	
Lack of coöperation	25	
Referred to private physicians	5	
Nurse's visits to the homes		1126

MISS ERNST'S REPORT (2 MONTHS)

WHITE PATIENTS

	Male	*Female*	*Children*
New:	10	1	9
Old:	17	11	14
	—	—	—

Total 62

	Total
Pre-natal patients—3 old, 15 new	18
Babies — 4 old, 11 new	15
Pre-school age — 2 old, 5 new	7
Gynecological Clinic	4
Patients' visits to clinic	190
Nurse's visits to homes	68
G. U. Patients	44
Tbc.	1

Gynecological Patients. 2
Post-natal patients. 14
Pre-natal patients. 27
Wassermanns. 34

The following table shows the number of colored patients from the opening of the Institute up to the present:

NEW COLORED PATIENTS

1904–1921

	Male	*Female*	*Adult*	*Child*	*Total*	
1904.	32	15	40	7	47	Mostly ward patients.
1905.	18	10	26	2	28	
1906.	46	30	55	21	76	
1907.	36	22	50	7	57	
1908.	33	16	43	6	49	
1909.	36	31	57	10	67	
1910.	20	17	32	5	37	
1911.	28	20	37	11	48	
1912.	23	22	41	4	45	
1913.	34	23	49	8	57	
1914.	66	55	106	15	121	Colored nurse began work.
1915.	56	61	No record	No record	117	
1916.	70	71	" "	" "	141	
1917.	73	69	" "	" "	142	
1918.	70	70	" "	" "	140	
1919.	77	113	" "	" "	190	
1920.	129	116	" "	" "	245	
Total.					1487	
1921 (Feb., Mar., Apr.) New cases.					114	

Colored patients receiving treatment in 1919:
833 individual patients.
1047 treatments given to 833 patients.
Colored patients receiving treatment in 1920:
1358 individual patients.
2099 treatments given to 1358 patients.

It will be noted that in 1914, the number was more than double as a result of the educational efforts of the colored nurse for about six months; and later by the addition of another colored nurse.

During the years 1916-1918, the number stayed at about the same level. This can probably be credited to the unusual prosperity due to war activities. With the closing of many of the war industries, the number of patients noticebly increased, — (190 in 1919; 245 in 1920). For the first three months of the present fiscal year, the number of new patients has been 114. If this ratio continues, the number for the year will approximate 450. The figures given here relate to the general tuberculosis dispensary. In November, 1920, an additional colored nurse was

secured. She has charge of the syphilis clinics and of the colored pre- and post-natal clinics.

About 30 per cent. of the Negro patients visiting this dispensary have syphilis, as shown by a Four Plus Wassermann. The result is to show that many need specific treatment. These clinics are held on Monday afternoons for women and children, and on Thursday night for men. The result of putting a Negro nurse at work among the Negroes is again well shown by the development of the pre- and post-natal work. The following table shows the development of this work:

NEGRO PATIENTS IN SYPHILIS CLINIC
(Report for 4½ months)

	Male	*Female*	*Children*	
New:	24	29	7	
Old:	63	65	18	
	87	94	25	
Total				206
Pre-natal				28
Babies				37
Pre-school age				10
Number of visits to homes				258

Starting with nothing, she now has 28 pre-natal and 37 post-natal patients under observation.

Another Negro activity of considerable interest is the establishment of two classes for under-nourished children. These classes are conducted by a colored nurse and a colored physician. Although conducted under the auspices of the Philadelphia Health Council, they are the result of the demonstration class conducted by the Institute a year ago.

It might be added that since the first colored nurse was engaged in 1914, seven are now employed in public health work among the Negroes. The Visiting Nurse Association has two, the City two, the Philadelphia Health Council two (one of whom is assigned to the Institute), and another is shortly to be added; and the Whittier Center has one, also assigned to the Institute.

Two additional Negro physicians have recently been added to the staff of the Institute.

The problem of dealing with the Negro is becoming a serious one for us. The work has developed to such an extent that it threatens to swamp us. We have under consideration the renting of a building near by, and transferring to it all of the Negro activities. This plan, however, will have to be approached carefully, in order to avoid the suspicion of segregation. A suggestion as to this plan has already aroused suspicion. In order to complete the experiment, however, this would seem to be advisable. The feasibility of utilizing Negro physicians and nurses has been definitely proved. What they can do, if placed more completely on their own resources, remains to be seen.

SUMMARY

As the matter stands at present, there is operating at the Institute a clinic held by and for Negroes (with expert white guidance and supervision) which is doing health work on the most modern lines and with a degree of competency which compares favorably with that of the average clinic for whites of the same kind. It is the only venture of the kind in this vicinity, and we know of no other like it anywhere. The general method of approach is that followed by most successful effort in connection with the Negro (as good a quality of endeavor by the Negroes themselves as can be secured with careful, sympathetic direction and supervision by whites).

The importance of the problem may be emphasized. Philadelphia has to-day upward of 125,000 Negro residents. They are only partially segregated. As servants, they go most intimately into many homes of the whites, and are a constant source of possible infection there. Vienna to-day, under conditions bordering on actual starvation, has a tuberculosis death rate of just about 500 per 100,000 living. Among the Negroes of Philadelphia in 1919 the death rate, on the same basis, was 477. Viewed in this light, the problem is truly appalling.

All concerned, the Whittier Center, the Pennsylvania Society, the Philadelphia Health Council, and those who have supported the Phipps Institute, have reason to congratulate themeselves on the success of this effort to date.

For the future it may be possible, with combined and additional support, to predict the following accomplishments:

The system of work (active, well trained and well supported colored workers, supervised by and associated with the most competent whites) may be extended to cover the problem in this city.

Certain parts of the work may eventually be transferred to the city or State Department of Health for operation.

Facilities may be afforded for the training of additional colored workers, physicians and nurses.

The system may come to be regarded as a model by those interested in health problems in other places having a concentrated Negro population.

The result may be to reduce the present appalling tuberculosis mortality among the Negroes to approximately the normal level for the community.

It would appear that all organized effort to accomplish the latter objective should be considered, at present, to be also an experimental check on the current methods of anti-tuberculosis work of similar practicability and value to the so-called Framingham experiment, which is at present attracting so much attention.

DISCUSSION ON PAPER BY DR. LANDIS

Dr. Charles R. Grandy, Norfolk, Va.: I am glad to be able to report on a piece of work that has ante-dated that of the Phipps Institute of Philadelphia. The Norfolk Tuberculosis Society has had a separate clinic for colored people for fifteen years and has also been able to have colored nurses for some time. We have had no trouble in getting the colored people to come to the dispensary. They have come and brought their friends. The only difficulty is that they sometimes bring in people who have all kinds of trouble other than tuberculosis.

We run a dispensary, which, in a city of much smaller population than Philadelphia — I suppose the population of Norfolk is around 40,000 — compares well with that of the Phipps Institute. We have a colored nurse who works there regularly. A second colored nurse has been added recently and that is one of the points I want to bring out. We turned over the seals to a committee of colored people, letting them receive the same proceeds from the sale as did the white people, the agreement being that the money raised was to go entirely into the colored work. With the proceeds of the sale, they are employing a nurse who is to do survey work and who is under the tuberculosis association largely. Besides these two nurses, we have in Norfolk another colored tuberculosis nurse employed by the health department and two colored school nurses employed by the health department. Colored nurses, I believe, should be under a white supervisor, to whom they can go for help. Under those circumstances, they will give very excellent work. Under the direction of the health department there has been organized a colored health center, to which the various colored doctors give their services. This center will do prenatal work and various other work among the colored people.

In regard to letting the colored physicians and nurses run their own dispensary, we tried that several years ago and failed. At that time, they were not sufficiently educated to carry on the work without direction.

I am glad Dr. Landis has taken up this work and I feel that I can assure the white workers both in the South and in the colored centers in northern cities, that the colored persons if treated like people, like "folks," as they express it, will come to the dispensary whether it is run by white people or colored people and they will co-operate. When you have people who have been coming to you off and on for 10 or 15 years and bringing their friends, you know that they appreciate the work.

Dr. M. J. Fine, Newark, N. J.: Being encouraged by the report from Dr. Landis a few years ago about the work among the Negroes, we established a colored clinic in Newark, three years ago. We couldn't get the colored patients to come to the clinic at first, and we have seventeen thousand Negroes in Newark. In 1917 we secured one colored

nurse and two colored physicians, and since then our clinic has increased immensely. Last year, our nurse made 2385 calls, and at the clinic we had 1468 patients. We had 80 deaths last year among the colored people and 400 among the whites, showing that the prevalence of tuberculosis is very high, and that there is one death among every 200 Negroes.

The clinics, especially children's clinics, are very well attended. The Negroes seem to take pride in coming to a white clinic; however, they do not want charity and when they come to the colored clinic they feel it is their own. It is conducted by the tuberculosis division of the department of health and they think that the department of health is obliged to give them all the help and aid that they need and therefore they respond well. When the division conducts a survey, the white nurses gather the records of the colored patients and refer them to the colored nurse. The patients are referred to their own clinic.

During the war, we also had a night clinic, which was well attended, the Negro population of Newark at that time being considerably increased owing to the extensive industrial work.

I would again say that colored clinics and colored nurses and physicians are essential to the health work of any city.

Dr. H. G. Carter, Burkeville, Va.: We have in Virginia, I think, the only tuberculosis sanatorium for the treatment of incipient tuberculosis in the Negro race in the country. Our experiences are similar to those of Dr. Landis. First, it is essential at the present time that white supervision be maintained over Negro work. Second, and no less important, that the actual contact work should be done by the Negro. We find that with a colored attendant in direct charge of the patient we get better co-operation. It is difficult to get a woman or a man from among the colored people with initiative enough to direct work, and we find it almost as hard to get a white man or woman who understands and sympathizes with the Negro viewpoint, in order to get his full co-operation and confidence.

We have at Piedmont a white resident physician and a superintendent of nurses; our assistant head nurse, ward nurses and nurses in training are colored. We conduct a training school in connection with the sanatorium. This training school is on the same footing as the white sanatorium at Catawba, under the jurisdiction of the State Board of Health and offering a two years' course of training specializing in tuberculosis work. Our nurses affiliate with a general hospital, and most of them take the three year course in order to become registered nurses.

Our death rate in Virginia, while not as high as that cited by Dr. Landis in Philadelphia, is considerably greater than the death rate among the whites — 101 to the 100,000 in the whites and 251 in the colored. I consider that the prevention and treatment of tuberculosis in the Negro race is the most important health problem in the South today, and I am glad to say that the South is waking up to a realization of this fact.

We should eradicate tuberculosis in the race for humanity first, and as an industrial problem second; or from the standpoint of the purely selfish man, on account of the indirect effect on the white race. Over fifty per cent. of our colored patients come from white homes where they are employed in the capacity of nurse girls or cooks.

Dr. Albert Robin, Wilmington, Del.: We have had in Delaware a sanatorium for colored consumptives for several years, perhaps ten. We also have a separate clinic for the colored people of Wilmington, conducted under the supervision of the State Tuberculosis Commission, with a Negro physician in charge. Lately, within the last three months, we have added a Negro nurse.

The difficulty that we have had has been to get the Negroes to go to the sanatorium. They are rather shiftless, careless, and uneducated, and as a rule prefer to remain at home until the last minute, and we have had patients at the sanitorium who insisted on going home to die. We have had little trouble in having them come to the dispensary to get medicine. I want to ask Dr. Carter whether he has early cases of tuberculosis in his sanatorium, and how he succeeds in keeping them there.

Dr. Carter: I want to say in reply to the doctor from Delaware that we have very little difficulty keeping our patients long enough to effect a cure in the greater number of the cases. We have a few of the "ignorant, shiftless" type to which the doctor refers and these patients will not remain with us. By far the greater percentage of our patients follow advice and stay with us from three to six months and some longer. Our gas cases we have no difficulty in keeping from one to two years. They all know that to leave the sanatorium against advice means that they will not be able to return to us in the future. We had discharged about five hundred patients on January 6, 1921, of whom 217 were improved. The average length of stay in the sanatorium as stated in our three annual reports was something over four months.

Miss Agnes D. Randolph, Richmond, Va.: I would like to answer the statement about the shiftlessness and lack of education of the Negro. I am a Southerner, was born and raised in the South, and one would suppose I would bring the charge to the Negro of shiftlessness and lack of education, but I do not. The Negro is shiftless, he is uneducated, but we must remember that he has had only fifty years in which to get any education at all. The burden of the care of the Negro race rests frankly upon the white race. The health education of the Negro of the South is the burden that the tuberculosis worker bears upon his or her shoulders.

Our death rate, I am glad to say, has been cut in the last few years, and I firmly believe that one of the ways in which we have succeeded in cutting it is through the education of the Negro. There is no more responsive individual in the world. His lack of education is one of the most pathetic things that anyone can face.

According to our standards, he knows nothing of hygiene, sanitation or medicine, and is ignorant of every modern idea regarding the con-

trol of tuberculosis, and it is our responsibility to educate him. I wish that I could tell you some of our experiences in Negro churches which have shown their earnestness and their eagerness. The fact that the Negroes do go to our hospital and stay there and then go away preachers in the crusade of prevention and cure, proves that they are really adaptable and that they are teachable.

I am not at all capable of talking about the Negro of the North. He is a different type of person. I absolutely do not understand him.

The Negro in the South goes to the hospital because, first and foremost, he believes in the white race and he believes in our teachings. The educated colored man has faith in us and so has the uneducated man. It is by comprehension and sympathy and knowledge of their lack of knowledge of the disease that we get our patients to go into Dr. Carter's hospital and to stay there. We have been very proud of our record at Piedmont.

I don't believe there is any greater problem in the South than this care of the Negro consumptive, and I don't believe we are going to approach it except through the most profound sympathy. Therefore, any intimation that they will not take the treatment, any intimation that we cannot educate them, is a backward step. We must keep it firmly in our minds that it is through our faith and our knowledge that the colored man is going to be benefited, and only through our faith and knowledge will he ever be benefited. It was said, before we built the State Sanatorium for Negroes, that we couldn't keep our beds filled, and I am glad to say that starting with 40 beds we increased to 80, and they are all filled and now we want 145 and we'll keep right on.

The Chairman: Dr. Landis, will you close the discussion?

Dr. Landis: I have only this to add: That, as Miss Randolph pointed out, the tragedy of this race is their ignorance of health matters. I am firmly convinced that, whether it is the northern Negro or the southern Negro — and remember, so far as our northern population is concerned, it has been augmented by the southern Negro by nearly fifty thousand in the last four years — the only and the most feasible way of bringing about these educational matters is through trained people of their own race.

As to the capabilities of the nurse or of the physician, there is no public health work that I know of in which you cannot draw up a perfectly good, comprehensive scheme as to what you ought to do, and that scheme is going to succeed or fail entirely through the personnel — the people who carry it out. There have been all sorts of ventures tried that have been successful. The same methods have been tried by others and failed, or been only partly successful. In every instance the reason why they have succeeded on the one hand, or failed on the other, is not because the plan was a bad one, but because the wrong people were put on the job.

That holds just as true of the Negro nurses and physicians whom you employ as it does of the white, and I want to state, so far as my experi-

ence goes, that proportionately, there are just as many incompetents in the two professions among the whites as among the Negroes. When you say that Negro nurses are inefficient, then your experience happens to be that you had poor ones. As far as my experience goes, I have had just as efficient colored nurses as white ones.

I think a great deal of the success of our work at Philadelphia, has been due to the personality of Dr. Minton, himself a colored physician and the man who, I believe, has made this thing largely what it is. I, personally, shall not rest satisfied with this experiment (because I still consider it an experiment) until he and his staff and nurses are, with only occasional supervision, conducting this work independently. He is doing it today with very little help on my part.

I am glad to hear that those from the South believe this is the medium through which this work should be carried out, and it is true that if these people are treated as people, they will readily respond. Remember that you have a field that is untilled and you can expect failures, but if you can succeed in a small percentage of the cases that you deal with, you are at least making headway.

COMPREHENSIVE COOPERATION IN THE TUBERCULOSIS PROGRAM

By W. McN. Miller, M.D.

St. Louis

That which I am about to present to you, in general terms, is an appeal for a broad comprehensive constructive program in national, state and local tuberculosis work. It will be my plan, first, briefly to present in historical review the work of the National Tuberculosis Association and its affiliated state and local tuberculosis organizations, setting forth more particularly:

(1) Its early preëminence in the field of nation-wide health organization work in peace time.

(2) Its early coöperation in national, state and local official health service and with volunteer health organizations.

(3) Its priority as a nation-wide organization, seeking to control a specific disease.

(4) Its early institution of methods of combating infectious diseases, *e. g.*, special visiting nurse service, special hospitals, special schools, special health educational methods, both special and general health legislation, special community research and demonstration methods.

(5) Its leadership as a peace-time organization in raising considerable funds and expending the same systematically to achieve the above stated aims and purposes.

Further, I would aim briefly to set forth the relationship of tuberculosis to other diseases, to indicate their interdependence and to show the significance of the tuberculosis program to various human interests and activities — educational, industrial, financial, philanthropic, sociological, medical, health and life underwriting, legislative — and to solicit the coöperation of these interests in a coördinated nation-wide program.

In peace time, prior to the war, with the coöperation of a thousand affiliated state and local tuberculosis societies, the National Tuberculosis Association was the largest volunteer health organization in the world. It and they together did more intensive work and throughout a wider field of service than ever had any other volunteer organization. Only during the period of the war with the insistent and peremptory demands of war-time emergencies and disasters, did any other volunteer health organization do work which has surpassed in volume and intensity what these tuberculosis organizations already had been doing in America.

Through their concerted action over six hundred tuberculosis hospitals

and over five hundred tuberculosis clinics and dispensaries had been established; hundreds of open-air schools set into operation; many tuberculosis night and day camps organized; many local health surveys conducted; and a nation-wide campaign for the teaching of health habits to school children permanently established.

Through their activities, tuberculosis visiting nurse service — the first public health nurse service to be instituted in America — was established in thousands of communities; state, city and county public health departments had been reorganized and improved; open-air or open-window sleeping had been made almost a national habit.

The character and the extent of the work of the National Association and its affiliated organizations largely have been determined by the nature and incidence of the disease. Only within the last year or two has tuberculosis relinquished to any other disease a higher rating for mortality.

No disease is more widely spread, entails more hardship or suffering, more restricts opportunity to acquire wealth, produces more unhappiness and grief, more seriously disturbs the welfare of the family, more frequently breaks up the home, more often frustrates individual hope and ambition, than tuberculosis.

War has brought to the attention of the world the significance of tuberculosis as a destructive disease with its resultant invalidism, distress and poverty, and its impairment of the vitality, efficiency and man-power of the nation, as well as a widespread knowledge of the relationship of tuberculosis to concurrent diseases, especially in childhood.

In each year, in the United State, the number of deaths from tuberculosis more than equals two times the total loss of life in the American Army throughout the World War in battle, from accidents and from disease. Tuberculosis menaces the homes of the rich and the poor. It is humanity's most persistent, most universal, most destructive, and most distressful scourge.

Opportunity for infection with tuberculosis is universal. Seventy-five or more children of a hundred who reach sixteen years of age already are infected, as are most adults. Of every three men and women who die in the normal age of productivity and in the age of responsible parenthood, eighteen to forty-five years, one dies from tuberculosis. Of every ten people who die from any cause, one dies from tuberculosis.

Most people being already infected with tuberculosis, the problem to be solved is: How most effectively and at least cost to the state shall we prevent the development of latent pulmonary tuberculosis into its active form, consumption? The answer to this is: Build up and retain the resistance of the individual to the disease by keeping him, whether child or adult, in a state of vigorous health. The fight for health and the fight against tuberculosis are coterminous, are one and the same.

The program of procedure to secure control of the disease at least cost necessarily must be comprehensive, coöperative, persistent, educational. No volunteer organization having for its object the betterment of social conditions should seek to establish and thereafter bear the responsibility

for its execution. Any cause worthy of effort should have in itself the merit, which when recognized will itself find justification in official support by the local community, state and nation. The resolution on the part of the community or state or nation to assume these responsibilities must find expression in acts of legislation, and inasmuch as legislation usually is associated with the expenditure of funds, due regard should be paid to the practical or economic aspect of the object for which legislation is enacted.

Dr. Eric Crull, President of the Indiana Tuberculosis Association, in a recent address before that organization said, "In trying to enlist the active support of the business man, we must forget the hearthache, the suffering, and the mental agony which we tuberculosis workers see daily caused by this disease. We must emphasize purely the economic business proposition of public health; we must drive home primarily the economy of better health and never forget to impress the taxpayer with the fact that the elimination of tuberculosis would mean the great reduction of taxes and demonstrate the financial side of the metamorphosis of a consuming invalid into a producing taxpayer. The confident coöperation on the part of laymen is all important. I would rather be able to enlist in any health movement ten club women, or ten bankers, or ten grocery keepers, or ten people from any mixed group or club, than rely upon one hundred doctors."

From the point of view of the economic aspects of tuberculosis, these tremendously important facts pertaining to the disease must always be kept in mind by social workers, trite as they may be: Tuberculosis is not inherited, it is transmissible, it is essentially a disease of childhood, it is commonly transmitted to the child through parental ministration in the home; susceptibility to the disease is highest in infancy and resistance to infection and to the process of the disease increases with age; the period of life in which death from tuberculosis most frequently occurs, is in the age of parenthood; post-mortem examinations show that nine out of ten who die have been infected with tuberculosis.

Reasoning from these facts as a basis, our efforts should be directed chiefly and constantly to increasing the resistance of the individual in childhood and adolescence and to preventing the transmission of the disease from the parent to the child within the home.

By whatever means we fight tuberculosis — by publicity, education, open-air schools, nurse service, sanatoria, dispensaries, clinics, hospitals, health surveys, or by periodic physical examination — we ever must bear in mind that the most vulnerable period in life in which to attack the disease is in childhood and in adolescence, and then by education in the home and in the school.

The control of disease by police power, even in the larger cities, is limited; in rural communities police power cannot or does not control transmissible diseases at all. In these communities practically the sole means at our command to achieve this goal are publicity and education.

In consideration of what has here been related, it readily becomes apparent that the campaign against tuberculosis should become a cam-

paign for child welfare, for the prolongation of life, for the betterment of living conditions, and that this campaign can best be conducted by organized coöperative and coördinative effort of all governmental and volunteer agencies.

The reader, who is the Executive Officer of the Tuberculosis Association of the "show me" state, with some hesitation and much timidity, will endeavor now to "show you" some of the methods and results of its practice of coöperation with state departments and volunteer social organizations.

In 1916 the State Association first organized its "Women's Coöperative Committee" which later has come to be known as the "Missouri Women's Health-Education Committee, Coöperating with the Missouri Tuberculosis Association."

To exhibit the purpose and plan of work of this committee, I shall read a few paragraphs:

It is designed that this, the Women's Coöperative Committee of the State Association, acting in coöperation with the Committee on Education and Course of Study, the Press and Publicity Committee, Committee on Amusements, Recreation and Playgrounds, together with other committees which are provided for by the by-laws of the Association but which are still unorganized, shall provide for the ultimate organization of a Council of Health Agencies in each school district, and of a County Conference of Health Agencies in each county.

It is intended that these several organizations or health agencies, in common with this Association, shall have for their aim, the suppression of tuberculosis; for their work, the crusade against the disease; for the ultimate object of their work, the promotion of health and social and economic welfare, in all Missouri.

It is expected, and experience justifies expectation, that the funds to carry on this work will be provided by the sale of Christmas Seals, augmented by contributions from corporations, firms, and individuals whose interests and welfare will be promoted thereby.

The by-laws of this Association provide that the Women's Coöperative Committee shall consist of members nominated by state women's organizations, to be confirmed by the President of the State Tuberculosis Association, counselled by the Executive Secretary.

This committee was organized for the purpose of bringing into efficient coördination and concerted action, all organized efforts pertaining to health and child welfare common to these several organizations. The plans for representation and for service are but tentative and will be modified and adjusted to efficient service for the cause as time passes.

By this plan of state-wide coöperation of women's organizations the collateral interests which they have in common with one another and with this Association, will be brought into harmony, and efforts to attain the desired ends will be made effectively convergent, not independent, parallel, even divergent.

In the Missouri Women's Health-Education Committee, the change in

name being made to conform to the spirit of the nineteenth amendment, the following state-wide women's organizations now have representation: Federation of Women's Clubs, Parent-Teachers Association, Catholic Women's League, Council of Jewish Women, Woman's Christian Temperance Union, Daughters of the American Revolution, Daughters of Rebekah, Lady Maccabees, State Teachers Association, League of Women Voters, United Daughters of the Confederacy, P. E. O., Grand Army of the Republic Relief Corps, and Eastern Star.

Of the state departments and institutions with which such coöperative relationship has been established in the past, I merely may mention the following: Executive, state, public schools, health, teachers colleges, and through the State Board of Health, the United States Public Health Service.

Such relationship also has been maintained with county and city superintendents of schools, the State Teachers Association, State Dental Association, Children's Code Commission, Rotary Clubs, commercial clubs, county medical societies, and other county and municipal organizations.

This statement is made merely to illustrate the range and extent of the Association's coöperation. In evidence of the results thereby achieved allow me, please, to read these few lines from a table of comparative health statistics based upon mortality reports for the years 1911 to 1920, inclusive, published by the State Board of Health:

	Year 1911	Year 1920	Variation Per Year
Deaths from tuberculosis, all forms ...	5113	3592	Decrease 3.3 per cent
Tuberculosis death-rate per 100,000 population.	155.27	105.52	" 3.6 per cent
Percentage, deaths from tuberculosis of deaths from all causes	11.76	8.22	" 3.4 per cent
Death-rate from causes other than tuberculosis per 100,000 population..	1161.1	1174.5	Increase 0.12 per cent

The work of the State Association has been chiefly educational, conducted for the most part through the schools of the state. It has yielded results in Missouri, possibly unsurpassed by any state in the Union, despite the lack of county tuberculosis hospitals and tuberculosis nurse service.

From 1911 to 1919 the death rate from tuberculosis decreased more rapidly in the state outside of St. Louis and Kansas City than in these cities. In rural Missouri the fight conducted against tuberculosis has been almost exclusively educational; it has been coöperative.

Of the results achieved within this year, 1921, are those of the legislative campaign which has just been concluded with the adjournment of the regular session of the Missouri Legislature. Outstanding are: (1) Increased appropriations for the State Board of Health, over two and one-half times that of the biennial period of 1919-20; (2) The passage of a concurrent resolution approving the annual observance of a School and Health Week by the public and private schools and by all health and educational institutions and organizations in the state, in the month of December; (3) The passage of the Physical Education Bill. This newly

enacted law provides for: (a) instruction in health habits, (b) physical training and supervision of the health of pupils of the public schools, (c) securing sanitary condition of school buildings and playgrounds, (d) control of school athletics, (e) employment of school nurses, (f) certification of the health of teachers, and (g) the training of teachers to carry out its provisions.

In testimony of the effectiveness of this coöperative plan the editor of *School and Community*, the official organ of the Missouri State Teachers Association, in its current issue has said:

> The (Missouri) Tuberculosis Association is one of the best allies of the Missouri Public Schools.
>
> The work of this association is essentially educational work. While it does not concern itself directly with the problems of the public school as such, it does deal and has dealt very effectually with the fundamental and foundational matter that underlies the whole educational superstructure — the health of the child.
>
> To the work of this association more than to any other organization do we owe gratitude for the progressive health legislation of the past years. To enumerate the health laws of the state would be but to name the successful legislative enterprises that it has launched or supported to a successful termination.
>
> Supported by the small subscriptions of many individuals, voluntarily contributed, it has moulded public sentiment and organized it until year by year it expresses itself in laws, public hospitals, good personal habits of health, and wholesome civic attitudes.
>
> Its influence is felt in every nook and corner of the state.

With this illustration of the methods followed and the results achieved in Missouri we may assume that the plan of coöperative educational service has stood the test. How is it with the program of the National Association?

In the report of the Managing Director of the National Association, presented yesterday, Dr. Hatfield gave us unmistakably an affirmative reply. In his report upon the National Health Council and the National Child Health Council, upon the coöperation of the National Association with the Bureau of War Risk Insurance, the United States Public Health Service, the Federal Board for Vocational Education, the National Home for Disabled Volunteer Soldiers, with the American Legion, American Sanatorium Association, National League for Nursing Education, Press Association, the National Bureau of Education, the National Education Association, Metropolitan Life Insurance Company, International Union Against Tuberculosis, Department of Public Health of the Republic of Mexico, and with various universities in medical research, we have a running-by-the-page affirmative reply that coöperation has a place in the national tuberculosis program.

Coöperation, yes. But is the coöperation comprehensive? No, nor is it in Missouri, nor in any state, nor any lesser community so far as generally may be known. We are headed in the right direction and are going forward but have not yet arrived. Not until coöperation is conterminous with the breadth of the baneful influence of tuberculosis upon human

interests, human efficiency and human welfare will it be fully comprehensive.

On the program of the sociological section of this annual meeting, of fifteen participants ten have qualified professionally as doctors of medicine, as though tuberculosis were preëminently a medical problem. In the Board of Directors of the Association it is prescribed that one-third of its membership shall be laymen, as though vocationally the interests of those concerned in tuberculosis are best served by physicians and surgeons, or as though two-thirds of the work needed for the suppression of the disease was medical in character.

It is conceded by sanatorium experts that those institutions have exerted only little determinable influence upon the tuberculosis death-rate. It is accepted by many capable judges that education is the process whereby the tuberculosis death-rate is being lowered. But where are the teachers on the program, in the Board of Directors or in professional public health service?

It is to the everlasting credit of the National Tuberculosis Association that through its Modern Health Crusade teachers in large numbers and in wide distribution have been enlisted in the service.

But what part in the play is undertaken by the health and life underwriters? Dr. Frankel of the Metropolitan Life Insurance Company can answer that question almost to a man. Who more than the life insurance policyholder should understand and appreciate the value of the lower risk in insurance? What are the tuberculosis associations doing to bring home to him the important fact that public health is a matter for his concern?

On the program and on the board are found a few, a scattered few, professional philanthropists, clergymen, social workers, manufacturers, merchants, bankers and attorneys. Have they as classes, or as representatives of interests, no interest or concern in the tuberculosis problem? Need no appeal be made to them on the score of their professional interests in the disease and its results?

What appeal is being made to organized labor? What representation has labor had in the councils of the national tuberculosis workers? Dr. Hatfield tells us that an effort has been made during the last year to increase the donations, particularly from the labor unions, and that two of them have contributed five hundred dollars each.

The eminent and able sociologist, Dr. Edward T. Devine, in the columns of the *Survey* has presented us with a series of articles upon welfare federations in which he endeavors impartially to give us the arguments for and against their methods and their influences. His chief interest centers upon their administrative control, whether by donors or by the social worker. He writes pungently at times. Note this closing sentence of a paragraph:

"A Chamber of Commerce which is earnestly and open-mindedly studying the problem of community needs as a whole, and the best way of meeting them, is more to be praised than a family welfare society which stubbornly opposes the effort to find any such comprehensive plan, or the national body which refuses to submit its

policies as far as they affect a particular locality to the common judgment of those who are concerned with the same problems in that locality."

The welfare federations are now a matter of much concern to the tuberculosis executive. The allied, or federated, drive for community funds, the so-called community chest, to finance all kinds of local, philanthropic and civic work, seemingly substantial and growingly popular, in the end must fail; for the movement is becoming less a plan for securing efficiency in service, from which motive it took its start, than a plan for lessening the annoyance and expense to them who contribute out of business expediency.

Originating as a movement to federate social agencies, to heighten their efficiency in service by coördinate activity, the principle has come to be applied to the raising of funds for their support.

Business, quickly recognizing the merits of the plan, commended the movement and lent a hand. But business is business, and the soul of business is administration, and the heart of administration is control.

Dominated by the principle of profit taking business, as business, will not for long lend a hand to social service or to civic betterment except as they be subordinated to its avowed purpose and objective — immediate profit. Social activities are not conducted for profit, not for immediate and direct profit, nor do sustaining contributors give largely out of business interests. They give out of specific personal interest in some particular phase of the public welfare as they give to friends or support their families.

In conclusion, from what has been presented we are justified, I believe, in approving and adopting comprehensive coöperation in the tuberculosis working program; but we must understand that coöperation means literally "working with," working for another as well as for self, and that it calls for self-denial and self-sacrifice on the part of all participating activities and interests.

AN EXPERIMENT IN ORGANIZATION OF RURAL TUBERCULOSIS WORK IN ALBEMARLE COUNTY, VIRGINIA

By Walter C. Klotz, M.D.

Charlottesville, Va.

The object of this paper is to describe the tuberculosis problem in a typical Southern rural community and to outline a program of work that would utilize all exisiting agencies and facilities in developing a permanent organization, and one which should be effective, without involving any considerable budget. Social, industrial, ethnological and topographical conditions have been taken into consideration in making this survey, and in studying the various factors that enter into the problem of rural tuberculosis work. Finally, attempt has been made to draw such conclusions as would offer suggestions for other similar communities.

While a study and survey of Albemarle County had been made in 1915, under the auspices of the State Tuberculosis Association, and a diagnostic drive had been carried out during the summer of 1919, when upwards of 3000 people had been examined, no permanent organization had been effected. The work along present lines with the object of establishing continuous dispensary service was begun in the early part of 1920. It owed its origin at this time largely to the fact that a tuberculosis sanatorium was established by the State Board of Health near Charlottesville and the University of Virginia. By affiliation between the University and the sanatorium, a practical course in tuberculosis instruction was arranged for in the department of medicine of the University. Coincidently also, a public health demonstration unit was organized for Albemarle County under the direction of a full time health officer, whose energy and enthusiasm were largely responsible for the beginning of the work. This health unit furnished a very convenient pivot about which to center the rural tuberculosis work, and through its personnel was able to carry out the necessary field and follow-up work. With the University situated at about the center of the county, offering out-patient, hospital, laboratory and x-ray facilities, together with a sanatorium of 120 beds on the outskirts of the city, it was only a natural conception to make use of and extend the educational work of these two institutions to the lines of public health, medical training and social service. In other words, there was here a very logical background for an ideal demonstration unit for rural public health work, the need for which has been emphasized, especially in the South.

Aside from presenting the advantages mentioned, Albemarle County showed conditions that were fairly typical of many parts of the United States and the Southern United States in particular. Charlottesville, the largest and in fact the only city in the county, has a population of 10,600 and offers a number of urban and industrial problems and conditions. The rural population of 24,000 is scattered over an area of about 480,000 acres, giving a population density of one person to 18.7 acres. Much of this area possesses a rich soil, and is given over to agriculture, the principal products being cattle, horses, grain, and especially fruit; notably the Albemarle pippin. In part, however, the topography is much diversified by rugged wooded hills and steep mountain valleys and coves, which on account of bad roads are almost inaccessible at certain times of the year after heavy rains. These topographical features have had a very distinct influence on the social conditions in these mountain settlements, which, while not necessarily very distant, are rendered remote by their lack of communication. Consequently, we find that from point of view of education and enlightenment, there is a marked contrast with the conditions obtaining in the more fertile, prosperous settlements in the rich bottom lands. According to tradition, the inhabitants of some of these mountain districts are descendants of Hession prisoners, who remained here after the Revolution, and many of their ideas have not advanced or progressed much since that time. Ignorance of any public health measures, unsanitary dwellings, even absolute illiteracy, are by no means uncommon, while intermarriage has probably contributed also to produce existing mental and physical defects.

As in all other parts of the South, the Negro tuberculosis problem constitutes an important and serious factor. Exact figures as to the proportion of Negro population have not been furnished by the last census, and on account of considerable dislocation of this part of the population during the war, it is not safe to make any close estimates. But based on the average of former years, it probably constitutes about one-third of the total population.

The tuberculosis death rate is about three times that of the white population. The reason for this higher death rate is not altogether racial, as a study of the differential death rate does not show a higher incidence among the colored population of the acute forms of tuberculosis: general miliary, meningeal and disseminated tuberculosis; the forms usually associated with primitive races. In the case of tuberculosis, "all forms," however, the mortality for children under five years of age is about four times as high among the colored as for the white. The causes for this higher incidence and mortality are due more probably to the modes of living, the small, inadequately built and still more inadequately sanitated cabins. But however ignorant the Negro may be at the moment as to sanitation, he presents a hopeful prospect as to future awakening under the proper educational stimulus. Thanks to his imitative instinct, he has in some instances responded most actively and enthusiastically, collecting through his own efforts the funds for a colored

public health nurse. Two former patients of the colored sanatorium in the State formed a flying squadron, touring the country in their efforts to awaken interest in anti-tuberculosis work among their people. On the other hand, we find the type of poor white mountaineer who is apt to be very unapproachable, suspicious of all innovation, and in whose eyes every stranger is a revenue officer unless proved to the contrary. He can be influenced only by close contact and actual infiltration, as is being done by the personnel of the mountain missions, which are doing excellent work and have given us the most hearty co-operation. Without their assistance any contact might have been impossible in many instances.

Climatically, the conditions of Albemarle County are favorable. There is a mean altitude of 600 feet in the eastern part, while the Blue Ridge Mountains along the western border of the county, rising to a height of 2500 feet, form a protection against the colder winds of winter. The average mean maximum temperature for the year is 67.1 F. and the minimum 45.8. The annual precipitation is 42.8 inches. The average humidity is 74.6, with a percentage of possible sunshine of 61.8. These figures are based on the average for the five years ending 1919, taken from the United States Weather Bureau Reports.

The average total mortality during the last five years was 15.2 for Albemarle County and 13.3 for Charlottesville. The rate for the colored population, like the tuberculosis rate, has been higher than that of the white, and higher for the rural population than for the urban. Hook worm and malaria are not common, while typhoid fever has been minimal.

The tuberculosis mortality rate and the number of deaths have been subjected to a more careful study, as shown by the accompanying tabulation. Comparisons have been made for the colored and white groups, both urban and rural, with corresponding groups for the State as a whole and the Registration Area. From these figures it appears that the mortality rate for all groups was somewhat higher than for the State as a whole and for the Registration Area. For the colored groups, the tuberculosis death rate was somewhat less than for the Registration Area as a whole.

The surveys of 1915 and 1919 were necessarily incomplete and could not offer any definite information as to the extent of tuberculosis morbidity. Our own work has just begun and we would be no more in a position to offer any accurate estimate of the actual number of cases existing. It has been our experience, as shown by actual instances, that the contacts and suspects are usually not the first to visit tuberculosis clinics or dispensaries. It is only after more permanent dispensaries are established and intensive follow-up work has been done that these patients can be induced by the visiting nurse to come for examination. Notification of cases by physicians has probably been about the same as in other communities where it is not rigidly enforced and the curves expressing cases reported does not usually exceed the mortality curve and frequently falls below. Our present organization has been handicapped by lack of sufficient personnel. It has been possible to employ only one public health nurse

Tabulation showing Tuberculosis Mortality for Rural and Urban, White, Colored and Total in Albemarle County, State of Virginia, and in the Registration Area.

Years	Albemarle County						State of Virginia						Registration Area					
	Rural			Urban			Rural			Urban			Rural			Urban		
	W.	C.	T.	W.	C.	T.	W.	C.	T.	W.	C.	T.	W.	C.	T.	W.	C.	T.
1913	18	20	38	6	4	10	1338	1373	2711	378	502	880	32172	4625	36797	48605	8019	56629
1914	21	23	44	5	5	10	1435	1565	3003	387	524	911	33778	5096	38874	49465	8564	58029
1915	27	24	51	7	7	14	1370	1708	3076	395	530	925	33901	5301	39202	49764	9228	58992
1916	16	28	44	2	11	13	1423	1542	2965	395	522	917	35564	7867	43431	49464	8502	57965
1917	22	33	55	12	11	23	1296	1686	2882	403	508	911	39091	9000	48091	52155	9898	62053
1918	20	28	48	7	14	21	1469	1614	3083	491	519	1010	44979	10957	55936	55033	10235	65268
1919	13	25	38	12	12	24	1204	1431	2635	363	497	810	44104	7992	52096	54595	8956	54595

assisted by one colored nurse. The diagnostic work has been done by the members of the sanatorium staff, assisted by fourth year medical students, while considerable work has been done by the health officer himself. During the session of the Summer School at the University members of the class in social service also gave us valuable help in this connection, while nurses from the sanatorium staff have been sent out occasionally in order to gain some knowledge as to this feature of tuberculosis activity. It is not to be presumed that our present organization is complete. Lack of funds has made it extremely difficult to continue the work at all. With the exception of the University Out Patient Department and the sanatorium, no permanent location or building has been provided. Clinics have been held in schools, chapels, or even in private dwellings, if no other place was available. The work has been done in the spirit of research and public service at such times as different members of our personnel could offer, and without any special budget or appropriation. Any estimate of the cost of this work is therefore impossible.

However, even under the circumstances clinics have been held at eight different places, a total of 13 sessions, not including those held at Charlottesville. These were not considered a part of the rural work, although a number of people from the rural section did visit them. Of the total 373 people examined at the rural clinics 14 were found tuberculous with active lesions and 17 inactive or arrested. During the time that the sanatorium has been opened, a little more than a year, 36 patients have been admitted from Albemarle County, including Charlottesville. Of these 26 have been discharged and 5 have died since discharge. In addition two colored patients were admitted to Piedmont Sanatorium, the colored sanatorium maintained by the State at Burkeville, while a number for whom application had been made could not be admitted.

The fact that of the 344 patients admitted to the sanatorium, which is a state and not a county institution, 36 were from Albemarle County would indicate that rural tuberculosis work plays an important part in establishing closer contact and more effective coöperation with the sanatorium. The Albemarle County contingent constituted about ten per cent. of the patients admitted, while the population of the county constitutes only about one per cent. of the population of the state as a whole. If such a limited and provisional organization could accomplish this much, how much more intensive and thorough would the results be with an adequately equipped unit, a unit which could be maintained at a cost of about 25 cents per capita per year.

The above results are sufficient to demonstrate, however, what has been emphasized repeatedly, that in order to accomplish the greatest amount of good a sanatorium should be affiliated and coördinated directly with an efficient and complete organization in the given field it is to serve; permanent rural tuberculosis dispensaries, with a sufficient number of visiting ing nurses to insure satisfactory follow-up and educational work after discharge. Where this work can be carried out by the sanatorium staff this can be made more intensive and complete. It ought to be more inter-

esting to follow patients from the clinic to the sanatorium and from the sanatorium back to the home, there to watch personally the after results of treatment. One member of the medical staff could be detailed in rotation for the field work. Assuming that the nursing situation may again reach a more normal condition and the present crisis no longer exist, it would be feasible and desirable to have some of the follow-up work visits made by the nursing staff of the sanatorium — junior student or assistant nurses working under the direction of a trained social service or public health nurse. We have found that this change from the routine work of the sanatorium was much appreciated and enjoyed, and if carried out more extensively would afford some relief from the monotony of continuous institution duty and tend to prevent getting into a rut, as so frequently results from the closed life of sanatorium routine. Visiting patients in their homes and seeing at close range the conditions under which tuberculosis has developed in actual cases would also give a better idea as to existing etiological factors that enter into the problem, while a better knowledge of the social and environmental conditions of patients would offer valuable information upon which to base advice and instructions to patients leaving the sanatorium. Such a procedure would help to insure greater permanency of results and tend to prevent the high percentage of exacerbations and relapse after discharge.

Finally this demonstration of the effect and influence of an institution upon the neighboring community would be an additional argument in favor of greater number of regional sanatoria of smaller size which can be in closer relation with rural tuberculosis work. Decentralization of direction and effort may increase administrative expense, but will result in greater efficiency and usefulness to the community served.

Since 50 per cent. of the population in the United States is rural, the above suggestion deserves fuller consideration. This is still more true of the South, particularly Virginia, where the rural population constitutes more than 70 per cent. of the total population. It would seem only sound, therefore, to demand a readjustment of all our tuberculosis machinery in order to reach the more remote and sparsely settled communities and to make our institutions more directly and more easily available for the people. For this purpose a more permanent type of rural dispensary or diagnostic center, along the lines suggested by Vaughan, in his discussion of the medical problem of the rural community, would be of the greatest importance and more lasting and thorough in its influence than the sporadic or transient diagnostic clinic. In our own case we hope to establish such centers permanently, where sessions will be held not less than every two weeks, using the University Hospital Out Patient Department as a central dispensary for those patients requiring x-ray, nose and throat and other special examinations. Here sessions are held three times a week, as part of the regular work of the medical department. In this way medical service and medical education can be developed hand in hand with the greatest benefit to both, coördinated at the same time with a department of public health, preventive medicine and social service.

DISCUSSION ON PAPER BY DR. KLOTZ

James Jenkins, Jr., Springfield, Mass.: We have the same plan in Massachusetts. It is a coöperative plan between the tuberculosis association and the state sanatorium. We have near us in Springfield the Westfield Sanatorium, and the expert diagnosticians of that institution make our examinations and our county nurses work up the clinics. We do not find that in a small town we can have clinics very often. The attendance at a clinic is usually twelve, thirteen or fourteen people, following considerable work on the part of our nurses who get out through the community and interest the teachers, nurses and health officials. The biggest clinic we ever had was in a little God-forsaken town that has no nurse, and only half a doctor — because the doctor divides her time between that and another town — and we had in that town a clinic of forty-seven. Out of that forty-seven we found one positive case fairly advanced which could be sent to the institution nearby, eleven suspicious cases, and eleven which were marked suspicious with a question-mark, and practically all of them undernourished and below par physically.

The plan for these clinics is considered in Massachusetts a great step forward in the extension work of the state sanatoria, and will be enlarged in other sections. Hampden County, in which Springfield is situated, has done the most work this year. We consider it not only an effective piece of work, one of the best we are doing, but a starting place for the whole health work of the small communities in which we hold the clinics. We weigh and measure the children sometimes as preliminary to the clinic work, and then we follow up those cases with examinations of the eye, ear, nose and throat, even going so far as to take the children, when necessary, to a sanatorium for an x-ray. I think the whole plan is a splendid one for the extension of the sanatorium work, that it is a necessary piece of work in the rural districts which need the work so badly, and that it is a splendid connecting link between the public and private organizations.

Miss Mary K. Akerly, Newport, R. I. I would like to ask Mr. Jenkins how he succeeded in getting forty-seven cases at the dispensary. Was there a school nurse in the rural district?

Mr. Jenkins: The place itself has no nurse, but the tuberculosis association has nurses. The work takes several days, and sometimes a period of two weeks or so. We have a clinic every three weeks.

Miss Akerly: What distance is the town from the sanatorium?

Mr. Jenkins: Perhaps fifteen miles.

Miss Virginia M. Chetwood, Hackensack, N. J.: We are attacking the problem from the other end, the county tuberculosis association, rather than the county hospital. The hospital is under construction, and we are hoping it will receive patients by September. The doctor who will have charge is the examining physician in our clinic, which is at the county seat. We have two field nurses. Weekly clinics have been held, the patients coming from all over the county. The largest clinics have

been twenty-five and twenty-six. We find that it is difficult for our doctor to give a careful examination to more than eighteen. Our Ford has been an asset in bringing to the clinic patients who otherwise would not come. The opening of a night clinic is under consideration, the establishment of two branch clinics immediately, and a third in October. We feel that we are the opening door to the county tuberculosis hospital, and will not have much difficulty in persuading our patients to go there. It is hoped that the nursing may be done by the student nurses from the two general hospitals in the county, thereby giving them instruction in tuberculosis nursing, providing proper care for the patient, and also lessening the cost to the taxpayers for that care.

Miss Agnes D. Randolph, Richmond, Va.: I am particularly interested in Dr. Klotz's paper, since it deals with the subject that we are constantly discussing in Virginia. There is one point I might mention about attendance at clinics, that may amuse you, and that is, that the average attendance in rural communities in Virginia is between one hundred and fifty and three hundred, and our difficulty, is, of course, in getting a sufficient number of physicians to make anything like approximately the adequate number of examinations.

There are two questions in my mind. The first shows laziness on my part, but being from Virginia I don't apologize. I have not looked up the census figures and so know nothing about comparison of populations in counties. I should like to ask how large a population Mr. Jenkins is handling in his county. The fact of the small population in our counties in Virginia makes Dr. Klotz's idea of the social influence of the sanatorium one of our most important problems, and I would like to ask Dr. Klotz how far that influence can radiate. We have counties of from three to five thousand people, approximately. Cannot a sanatorium such as Blue Ridge, coöperating with the local county unit of public health nursing and with physicians, coöperating also with the state board of health and its bureau on tuberculosis, carry the influence and dispensary idea from the sanatorium to the surrounding counties? Can it not form the radiating nucleus for six counties, for example, instead of one?

Mr. Jenkins: I don't know that I can answer the question you ask me. In Hampden County we have some large cities and these have their own clinics. We have perhaps fifteen small towns that we cover. I should think it was quite possible that that is a different phase of the proposition — to work up a rural clinic without the use of dispensary doctors.

Dr. Klotz: In regard to Miss Randolph's question as to the distance that this influence would carry, this depends upon all the topographical, sociological and ethnological factors as well as upon problems of communication. It depends upon the amount of force behind the person, or the individual. It is like the wireless; the range increases every day, according to the waves used. They have one at Bordeaux now that goes all round the world. If we can get a man who can vibrate actively enough and intensively enough, his influence would probably carry over a population of five hundred thousand, provided he has good roads and

enough Ford sedans. But seriously, I think it could be extended, under the existing conditions in rural Virginia, to a population of about one hundred and twenty thousand.

Miss Elena M. Crough, Manchester, N. H.: We have been carrying on an intensive case-finding and educational program during the past year in New Hampshire. We have had such large clinics that we have instructed our nurses to keep within a certain limit in order that the specialist may have time to examine the patients carefully and have a moment or two to give advice.

The last clinic we opened was last Saturday in a little town of six thousand people. I had made all preliminary arrangements, and the county nurse spent exactly one week in the case-finding. One hundred patients were examined during the afternoon and evening. The children's clinic was held from two to six in the afternoon and 63 children were examined. The adults came in the evening. Out of the entire 100 examinations only 47 were found to be non-tubercular.

We have twenty-two permanent tuberculosis clinics in New Hampshire, and we conduct thirty clinics a month. There are ten counties in the state and in nine of these tuberculosis work has already been organized and furnished with clinic and nursing service.

Mr. Jenkins: I want to ask Dr. Klotz a question, in partial answer to Miss Randolph's question. Should a sanatorium physician be out in the field working for any lenght of time?

Dr. Klotz: It is possible if he can do a little work at the sanatorium in the morning, and be back again every night in order to check up and see that everything is going all right.

Miss G. I. Pelton, Denver: I should be glad to hear somebody from the West speak. I am now working in a western state, at least two-thirds of which is mountainous. We have no state nor county sanatoria. Some of our sparsely settled districts are a hundred miles from the railroads. We have few county organizations and many of our counties (we have sixty-three) are as large as Connecticut, and some are as large as Massachusetts. We have a nurse in only twenty-four of these counties. I should like very much to know what workers in such western states do to cover and unify their territory.

Dr. George M. Kober, Washington, D. C.: While I do not come from the West, I passed fifteen years of my professional life in the Sierras in northern California, and I often wished we had such a health movement as is now going on, under the auspices of the so-called Health Crusade. I believe that if every school had a course in health work, it would materially reduce diseases in general, and tuberculosis in particular. These Health Crusandes in our rural districts should be supplemented by rural nurses, and when we have a combination of the two, I believe it will not be very long before we shall also have county organizations to take charge of tuberculosis and other health work.

My feeling is very strong that instruction in tuberculosis should be given wherever there is a sanatorium. That is the logical place, because

the men are usually well trained, and undoubtedly can do a great deal for the tuberculous subjects in the particular district where they are located. The sanatorium physicians are peculiarly well fitted to educate the medical profession in the diagnosis of even difficult cases of tuberculosis.

Where there are no sanatoria, I believe in the creation of health centers, not only for the study and diagnosis of the disease in which we are especially interested, but also for all other diseases difficult of recognition, and where, by so-called group practice and scientific aids to diagnosis, the public may receive the greatest possible benefit.

That would be my idea of a plan especially adapted to our rural districts where the people are certainly deserving of the greatest possible consideration and now in need of better medical attendance.

Member: What is the attitude of private physicians toward this clinic work in the counties and what methods have been used to arouse enthusiasm and to secure coöperation?

Dr. Klotz: That is a pretty broad question. It is one that I have discussed repeatedly not here in the Association, but in our state association. It is extremely important.

In all of this work it is fundamental and absolutely vital that the general practicing physician be approached, and that contact be made. He must be conciliated and brought into coöperation if the work is going to be permanently successful. You have to accept this as a fundamental principle. It has been stated very aptly by one of the eminent British public health authorities. I am sorry that I have not the exact quotation here, but it is to the effect that all social work in connection with preventive medicine must take into consideration the practicing physician if it is to be successful.

It is one of the mistakes that has been made in the past, that well-intentioned laymen going ahead without consulting physicians and taking them into their confidence, have in many instances antagonized them and thereby weakened and lost some of the effects of their work. It has been a principle with us always to have the "advance agent," (the visiting nurse) who goes ahead, call upon the local physicians in the community and tell them the object of the dispensary; that it is not intended to treat patients; that patients are not to be referred to any institution without being first referred back to a practicing physician; that the diagnosis will be reported to him. In Albemarle County, for example, in many instances we could not get the patients to come to the clinic except by consent of the doctor. Although he may not be up-to-date or progressive in medicine, the people have more confidence in the old local doctor than in any modern experts on scientific or preventive medicine, and if the doctor says "Go to the clinic," they will go, and if he says "Do not go," they won't.

Miss Chetwood: We always send a letter to the patient's doctor, saying that the patient has come to our clinic for examination, that our physician found certain conditions to exist, and that certain recommendations have been made. Patients who are examined and are not tuberculous

but who need other medical treatment, if they have no physician, are referred to one, with a letter of introduction, stating their inability to pay, if it exists.

We have had very good coöperation from the physicians in the county, and I think they appreciate the fact that we report back to them, whether or not they send the patients. I believe this is one step every clinic should take in regard to the private physician.

Miss Pelton: We have had a good deal of difficulty with private physicians in connection with our clinics; but we have actually proved that we have increased their work because we have been able to refer so many patients to them.

Dr. E. B. Hooker, Hartford, Conn.: I have been much impressed by what has been said about the difficulty of engaging the services of private physicians. In this really arduous task of examining a large number, there is needed a corps of physicians who do nothing but work of this type, who are not engaged in private practice. I should like to see in Connecticut, for instance, as part of the appropriation for tuberculosis work, a certain sum set aside to pay the salaries of competent men who will devote themselves exclusively to this work, going about in different parts of the state. It seems to me it is possible for these men, hired by the states or counties, to be centers, both of inspiration and definite help. The field secretary of the Connecticut Tuberculosis Commission is here, and I should be glad to hear how this suggestion strikes him. In Connecticut we have no state association, but we have a State Tuberculosis Commission which works under an appropriation by the state.

Hubert M. Sedgwick, Hartford, Conn.: There are two or three things of interest in our work in Connecticut which I would like to say at this time, and especially as Dr. Hooker has referred to our work.

Our intensive work began with an attempt to cultivate and establish local units. We have established fifty-five in the little state of Connecticut, which pretty well girdle the state. In organizing, promoting and developing these organizations, we pointed out to them from the State Tuberculosis Commission office that they would do well to develop nursing, and we promised them clinical facilities and the services of our experts from our five big state sanatoria, to hold clinics much along the lines that have been described from Hampden County, in Massachusetts. As a result we have established twenty-two clinics which completely cover the state. We furnish several cities of Connecticut with regular clinics.

One feature which has come from this I should like to mention. Connecticut is largely a manufacturing state, with congested centers of population. Through the influence of our fifty-five local units we were able to attract the attention of the manufacturers of the state to our health work, and as a result, they began installing industrial nurses, until now the nurses in the manufacturing centers have become a great feature of the health work.

We put at the disposal of the manufacturers our tuberculosis experts from our sanatoria. The manufacturers have become keenly interested and they have placed in some of the factories dispensaries and clinical facilities which are better than some of the cities have. We have twenty-two regular clinics in the state and we have furnished consultation services to fifteen more places.

May I refer to one by-product of what has come as a result of the establishment of the clinics in factories? The manufacturers of Connecticut, in two centers of the state, one toward the west and one toward the east, have gone down into their pockets and have provided x-ray apparatus for our sanatoria. That x-ray apparatus was not available in any other way, and we have been doing some progressive work in that research line.

I speak of this to show how one thing leads on to another. We started with the local units, developed nursing, organized the clinics and got the manufacturers interested, and our reward has come back to us through large gifts to our sanatorium.

All of this is pertinent to the paper which has been read, of the sanatorium as the logical center for this progressive work which is being taken up through the nurses and social workers in one coördinate whole.

Dr. Kober: In all these efforts it is desirable to plan the work with the view of not antagonizing the medical profession. It is well to appreciate the fact that treatment should be limited to the dependent classes. Diagnostic clinics will be of benefit to all, but we must differentiate between those who are able to pay a physician, and those who are not. No professional man is unwilling to take care of those who are unable to pay, but they do seriously object to being called upon to treat patients gratuitously or to have the state do this when patients are abundantly able to pay a fee. And with this matter in mind, I think you will find no difficulty in either New Jersey or elsewhere about harmonizing the conflicting views of the medical profession.

Miss Annie J. Morrison, Grand Rapids: The Grand Rapids Anti-Tuberculosis Society has been conducting clinics quarterly in six centers in rural Kent County since early in 1919.

When about to start this clinic service, the executive secretary and head nurse visited each center and conferred with the physicians and school principals. The coöperation of the latter is most important in the small town and is needed right from the beginning in getting publicity well distributed and in getting in touch with the children most in need of medical attention.

The program was presented to them individually for their opinion as to whether they thought it was the work most needed in their community. They were asked if there was any other need in their township which they would prefer having met by the money to be expended. This money we reminded them was raised in the community by the sale of Christmas Seals.

The program approved, we told them we could accomplish nothing

worth while without their active coöperation and asked for that also. In no instance was it refused. One physician said there was no tuberculosis in his community and clinics were not necessary. He did not oppose the work. Later we took up the examination of school children, making a general survey in each school. This was done in coöperation with the county nurses, of whom there are four. After compilation of data, the record cards with data with findings were turned over to the schools for the use of the nurse and school principal for follow-up. In all our work we have had the close coöperation of the physicians, but they have been particularly active and interested in the school work. They advise their patients to attend the clinics; many of them bring their patients in, a great number of them make a point of being there while the examination is made and at other times.

The publicity, newspapers, posters and dodgers, always bear the statement "Local Physicians Coöperating with Tuberculosis Specialist."

The chart used asks the question, "Who is your family physician?" Following the compilation of data in Grand Rapids the specialist who conducts the clinic reports his findings in each case to the family physician. These men understand that in every instance where the need for medical attention is indicated, the patient is advised to see his own physician, with the knowledge that the physician receives the clinic report also.

The above procedure has brought the society the good will and coöperation of all the people in the communities visited, including physicians.

Dr. Hooker: Miss Morrison's remarks are almost the most important we have heard this morning. It is all right to get patients into the clinics and make the examinations, but the work is of little value without some follow-up work. This method just described will make the examinations amount to something afterwards.

Dr. Klotz: I will simply sum up briefly several points. One is case finding. I think it is most demoralizing for the medical personnel who are examining to go over one hundred people and not find anything. So I think that the nurse should try to bring in the patients who are at least remotely liable to have some trouble, so that the score will run up between twenty-five and fifty per cent. This will stimulate the medical personnel to do better work. If they examine all day long and never find anything they will not continue interested in tuberculosis work.

There is one other point, and that is *service*. It is a question that Dr. Cabot brought out in his lectures on social work. You must make people feel that something is being done for them, whether it be giving them medicine, putting them in an institution, or something else, and that they are not just coming for nothing. They do not want to feel that they are simply making statistics for the county.

The third point to impress upon the lay worker, particularly, is that there is a limit to the number of patients that one physician can examine creditably in one day. I think it is twenty-five. When some one speaks enthusiastically of the "glorious" clinic they had with two or three hundred people present, I know that about four o'clock in the afternoon the

ears, eyes and every other sense of the man examining become perfectly numb, and that they simply go through the examinations after that in a perfunctory, subconscious sort of way. If there are any positive cases among them, they don't find them.

The American Commission in France, in their dispensaries, laid down twelve examinations for a clinic of two hours as the limit that any one person could examine and do it thoroughly. That is not practicable in a rural clinic, but I really think that twenty-five a day is enough.

In regard to the Colorado problem, I can well imagine the difficulty. I have lived in Arizona, and know the enormous distances, and I think practically, and without joking, that the only solution for the problem is for nurses to learn to fly. That seems to be the only way of covering distance effectively.

The final point is that the sanatorium is neither the beginning nor the end of the tuberculosis problem and tuberculosis work. It represents only one step or link in the chain, and in order to be effective it must be effectually and closely linked up with all the rest of the tuberculosis machinery in order to do the greatest amount of good.

FRAMINGHAM YARDSTICKS

By Donald B. Armstrong, M.D.

Framingham, Mass.

I presume a few of you have seen the exhibit at the other end of the hall on Framingham Yardsticks and probably it is unnecessary to take up a great deal of your time after there has been so much discussion of this subject.

I trust you have had an opportunity to measure these yardsticks and I hope you have not found them 35 inches to the yard, as somebody suggested the other day.

It may be said that the object of the Framingham Demonstration is an attempt to lower the mortality and morbidity from tuberculosis in that community. There have also been aspirations to set certain standards for tuberculosis work. Back at the beginning of the Demonstration there were a number of questions in the minds of the committee, such as: How much tuberculosis actually exists in a normal and typical American community? How much tuberculosis can be discovered in the early stages of the disease? How many cases treated in hospitals or sanatoria, etc.?

The experience from the Demonstration thus far, while not final, is perhaps to a degree translatable or interpretable into these tentative standards which have been called "Framingham Yardsticks."

Now it is, of course, too early to discuss the Demonstration from the point of view of final observations or results, but it is for these tentative preliminary standards that the material coming out of Framingham at the present time is being developed. It is not my intention to discuss these standards in detail because many of you are undoubtedly familiar with them.

In the first place, as to the question of how much tuberculosis exists in a normal American community, an examination of two-thirds of the population of men and women and children, representing different groups, different races and different occupations and social standings, indicates that about one per cent. of the people are suffering from active tuberculosis. A thorough investigation and search for tuberculosis cases over a period of four years indicates that between seventy-five and eighty-five per cent. of the active cases can be discovered in the early stage of the disease. The first and most intensive year of work in the Demonstration indicated that the ratio of active cases to annual deaths from tuberculosis was nine or ten to one. Those are simply illustrations. We have talked of them as standards, but further experience in Framingham or

elsewhere may modify them to some degree. They are, however, suggestive of our work today.

Now in regard to the type of community machinery which is most useful for detecting tuberculosis, the Framingham experience has perhaps thrown a certain amount of light. While we have recognized the importance of nursing work in tuberculosis, I think the Framingham experience has indicated that equally essential is the medical service for the discovery of cases of tuberculosis. Certainly public health work by nurses, as Dr. Frankel pointed out yesterday afternoon, is essential, whether it be infant welfare work, school hygiene, factory hygiene or any other activity, but at the same time to expect a nurse in a community with the usual clinical equipment and casual medical arrangements to bring under treatment all cases of tuberculosis that can be discovered, is placing too much responsibility and too great an obligation upon the nurse in that community. Unless such a nurse's work is supplemented by adequate medical machinery in the schools, factories and elsewhere, the work, in our experience, cannot be carried out.

In illustrating that point, take the industrial medical situation in Framingham. We have about five thousand industrial workers and about seventy per cent. of them have reasonable and adequate clinical facilities. About half of them are in one factory and are employed under a full time physician with a nurse or sometimes two nurses and reasonably adequate equipment. That factory had nurses for two or three years preceding the Demonstration and preceding the employment of a physician. The nursing service did a tremendous amount of good in that factory among the employes in detecting disease, treating emergency cases occasionally, improving sanitary conditions in the plant, etc.; yet during the first two years of the Demonstration before the medical service was developed to supplement this nursing and clinical equipment, practically no tuberculosis was discovered.

Now, with the addition of adequate medical machinery plus another very essential thing, namely, the compulsory medical examination of all new employes, last year twenty-seven per cent. of all new cases of tuberculosis discovered in the community were discovered through factory medical machinery. That shows the importance of a thorough medical examination for new employees.

Certain other standards, of course, have come out of the work. The number of cases that require institutional treatment is also important from the point of view of those conducting the program. In Framingham we have run between one and two cases under institutional care for every death, and it is our opinion, so far as our experience goes, supplemented by the experience in New York State and other places, that a minimum of one bed for every annual death is about as low as it is safe to put a ratio at the present time. Of course, at the present time, that has to be supplemented by a reasonably active tuberculosis program for the discovery of cases and for their treatment.

There is something that should be said about another aspect of

the Demonstration program, the educational work. We have attempted to carry out a reasonably complete education program and to experiment with certain aspects of such a program. The history of tuberculosis is in a sense made up of one hundred per cent. claims as to the cause of the disease. It was first said that environment was a factor largely responsible for tuberculosis cases, the housing and sanitary conditions, etc. The nutrition people now tell us that tuberculosis is largely a matter of nutrition. Those interested in racial development tell us that it is altogether a matter of race resistance, and so on. The economists say it is a matter of wages. Until we know a little more accurately the relative importance of these various etiological factors in tuberculosis, we cannot develop a rational program of education against these various causes of tuberculosis.

We know, of course, that out of practically every one hundred people, eighty-five or ninety per cent. will have tuberculosis infection; and probably at any one time, one or two per cent. will show evidence of active tuberculosis. Five, eight or ten per cent. are going to die of tuberculosis eventually. Therefore we have three avenues of approach, not only from the educational standpoint but from every point of view. Tuberculosis is, first, an infection, and we can do something against the spread of infection by improving our milk supplies and by controlling other avenues of infection. We need to educate people to insist upon the adequate care and restriction, if necessary, of dangerous and open cases of tuberculosis. Tuberculosis is, second, an active disease which is different from tuberculous infection and there must be educational work to build up resistance to the disease and eliminate, so far as possible, certain unnecessary stresses and strains, mental or physical, in the lives of people, to effect better economic conditions or adjustments: in other words, to try to build up a resistance against tuberculous disease. Tuberculosis is, finally, a cause of death and there are certain activities along educational lines which are needed to influence people to recognize the importance of sanatorium or hospital treatment and to popularize and adequately equip and operate hospitals and sanatoria which will do something to prevent or at least postpone death.

I said it was too early to discuss final results with reference to the Demonstration in Framingham. The important criteria are of course the morbidity and mortality rates. As to mortality, the situation is favorable though by no means conclusive as yet. The rates for the ten years preceding the Demonstration period averaged for the town 121 per hundred thousand for tuberculosis. Last year the rate was about 64.5, or approximately one-half of the original rate.

This year we are having an exceedingly good year. Thus far, for the mortality rate, the indications are that the rate will probably be between 30 and 50 or possibly about 40 per hundred thousand, which would be about one-third of the pre-decade rate. That, however, may be disturbed by unforseen mortality. If, however, it can be substantially demonstrated that the program will work, a program which is costing the community, not only for tuberculosis but for health work as a whole, about

two dollars per capita per year, and that two dollars per capita per year is a reasonable and adequate cost for health and tuberculosis work, then this work, if extended to all American communities and applied throughout the United States, would save from 75,000 to 100,000 lives annually from tuberculosis alone, to say nothing of the reduced morbidity. That would probably be a worth while result, a worth while demonstration, a worth while application of a health program to the community and to the country as a whole.

Just one more word, namely, as to emphasizing the variety of elements entering into such a program. It is necessary to enlist all of the resources of our communities to the attack on the tuberculosis problem. It is not only a medical problem, it is not only a health problem, but it is a social and economic problem, and all of the resources of our communities, educational, ethical, religious, social and medical, have got to be mobilized and have got to be enlisted in this attack upon the great white plague, if we are to do all that it is possible for us to do to prevent unneccessary sickness and to postpone premature mortality.

DISCUSSION ON PAPER BY DR. ARMSTRONG

Miss Jeanette Bradley, Bridgeport, Conn.: How do the private doctors coöperate with the clinic?

Miss Eva Mulford, Newark, N. J.: I should like to ask whether the nurse has the right or the doctor is the one to tell the person when he has tuberculosis in order that the precautionary measures may be fully carried out?

Miss Margaret G. Weir, Beverly, Mass.: I want to ask if the Dennison factory is still sending the tags into the homes for the children to work on and if the community has done anything about it?

Dr. Armstrong: I will take these questions in order as given.

The first one is the question as to the coöperation by the private physicians. There was one thing I did not mention, because that was discussed this morning by Dr. Bartlett, but not in this section, and that is the consultation service. This is most important in this connection.

The consultation service, which has been given or sold to the people or the physicians, is based upon the idea that the doctor frequently needs aid in diagnosis or advisory assistance in the treatment and in the classification of the disease, and this service has done more than anything else to interest the physicians and to encourage their coöperation and in every way bring them into good relation with the demonstration. Practically all, but not quite all, of the physicians of Framingham have worked in close coöperation with the office, pretty largely through the channels of consultation work. Consultation service, I believe, is something that can most justifiably be recommended to communities practically of any size, either on a state or local basis, to encourage coöperation with physicians.

As to the second question, I think that is very clear. The diagnosis should be made, under ordinary circumstances, by the physician and con-

veyed to the patient by the physician. In regard to the second part of that question as to who is supposed to carry out the instructions of the doctor in the home, I believe it is the nurse and that question is pretty clearly defined and answered.

The final question in reference to tags. One of the largest industries in Framingham is engaged in the manufacture of paper products. It is an industry which has shown a remarkable degree of coöperation and appreciation of the importance economically of the health of the people. Unfortunately it is an industry which has followed the unfortunate practice of placing certain parts of its work in the homes. I believe that practice to a certain degree is still continued, but I believe they have reasonable home supervision. However, this is a practice which, under ideal conditions, should be eliminated.

I believe I have covered the questions which were presented.

THE POST SANATORIUM CARE OF CANADIAN EX-SERVICE MEN

By Lieut.-Col. William M. Hart, M.C., M.D.

Ottawa

What I have to tell you is largely the result of a study that was made by a board of five medical men, who were appointed by the Department of Soldiers' Civil Re-Establishment of Canada to investigate the tuberculosis problem as it affects the Canadian ex-service man. This board prepared a series of reports dealing with the various phases of the problem for presentation to the Director of Medical Services, Department of Soldiers' Civil Re-Establishment. This board was under the chairmanship of Dr. C. D. Parfitt, who is acknowledged as the dean of those of the medical profession who devote their attention to tuberculosis work in Canada. The report, dealing with post sanatorium care, was passed by the Director of Medical Services to the Special Parliamentary Committee, which was sitting for the fifth year to consider the problems of pensions and reëstablishment for ex-service men. The remarks that I purpose making this afternoon are largely a condensation of this report.

Those of you who have been engaged in anti-tuberculosis work for any considerable time I think will agree with the statement that any system affecting to treat tuberculosis, which does not include the whole life of the consumptive must eventually end in failure. Statistics could be produced to show that sanatorium results, gratifying as they have been, far from fulfill the original expectations and hopes of the earlier workers in the field. I do not wish you to feel for a moment that I am not ready to acknowledge the great value of sanatoria in the anti-tuberculosis campaign, for I would be among the last to wish to do so, but the fact remains that sanatoria alone and unaided cannot but fail to produce the permanent results desired. The situation has been pretty well summed up by Krause, who says that "it is the reaction to his environment that sends the tuberculosis patient to the sanatorium; it is the reaction to the ideal environment of the sanatorium that sends him out an arrested case; and it is again the reaction to his environment which necessitates his return to the sanatorium." Krause adds that he wishes to give full credit to the sanatorium, but that it must be recognized that it is only a way-station, not the goal, in anti-tuberculosis effort. It is, however, the most important way-station yet devised or imagined.

The objective of post sanatorium care, it may be briefly stated, and possibly some of you may think too conservatively stated, is the prevention, or perhaps better, the postponement, of relapse. In our report we dis-

cussed post sanatorium care of the Canadian ex-soldier under the following heads:

(1) Financial compensation.
(2) Medical supervision.
(3) The provision of sanitary and comfortable living quarters.
(4) The affording of an opportunity for suitable employment.

Financial compensation, we felt, should be adequate to defray necessary expenditures and should persist throughout the whole period of readjustment following the patient's discharge from the sanatorium. Since coming to New York I have learned that the essence of the problem in dealing with your tuberculous ex-service men appears to be that your Government has been over-generous in affording an unnecessarily large compensation which has actually reacted against the effectiveness of the treatment. In Canada the patient's pay and allowances while under treatment are now practically the same as the provision under the Pension Scale, which in turn has been based upon the average cost of living prevailing throughout Canada in the opinion of unbiased experts, and upon the actual pay of civic employees. As a board we considered that on the whole, compensation while perhaps not inadequate was not at all excessive. We believed that there were certain requirements which were more necessary in the case of the tuberculous than for other types of ex-service men. Of these might be mentioned that of providing a suitable dietary although I do not wish to stress that point too much because it is recognized that an ordinary well-balanced diet is on the whole satisfactory for arrested cases of tuberculosis. I need not more than mention in passing the necessity for providing adequate clothing for the patient who is attempting to carry out the sanatorium regime in his home. Alterations and adaptations of his dwelling are also frequently necessary in the after-care of the tuberculous. A sleeping porch may have to be built; the windows of a room enlarged or made capable of opening; while the fact that he should sleep in a room by himself may make necessary a rearrangement of living quarters not required in the case of the non-tuberculous. It is essential, we felt, to the after-care of the tuberculous that they should as far as possible be freed from the anxiety arising out of too limited financial resources. It has indeed been well said that a lean purse is one of the main causes of relapse.

The limitations of the tuberculous are so well known to you all that it is scarcely necessary to mention them, but in its report published in 1919, the British Parliamentary Committee summed them up pretty well when it said, "the working capacity of the average consumptive appears much greater than it really is."

A factor which appears generally to be overlooked in the consideration of the limitations of the tuberculous ex-service man, and which justifies special attention from the standpoint of financial compensation, is his very greatly lessened expectation of life.

Altogether we felt justified in recommending, and did recommend, that as tuberculosis produces a permanent disability the Government should

recognize this fact by compensating the tuberculous ex-service man accordingly. This involved our urging upon those responsible that a minimum pension should prevail either for a period of years or indefinitely for those disabled as the result of tuberculosis.

Before this audience I need scarcely more than refer to the necessity for providing adequate medical supervision, but we felt that the Government should recognize that the tuberculous ex-service man should have the advantage of skilled medical supervision for as long as he should live.

Medical supervision for the first few weeks following a patient's discharge from the sanatorium is not sufficient and accordingly we recommended the extension of the existing clinic system in Canada in order to provide all tuberculous ex-service men, whether out-patients of the department or pensioners, with the benefit of skilled medical supervision for the rest of their lives.

We pointed out that the nurses in connection with these clinics should have special training to fit them for their duties and we laid down as a principle that these nurses should not only be graduates of recognized training schools with special social service training, but should also have special training and experience in tuberculosis work both in sanatoria and clinics. It was desirable also that they should if possible be ex-service nurses — former members of the Canadian Army Medical Corps Nursing Service. Even with all these requirements we emphasized the fact that without the possession of the personality and tact necessary these visiting nurses could not achieve a real success.

As I have just been reminded that the time remaining at my disposal is most limited, I will say nothing with regard to the provision of proper housing and will only touch very briefly upon the question of employment. We did not think it was possible to lay down a list of employments suitable for the tuberculous, but we endeavored rather to establish principles and in this regard we were very greatly assisted by that very excellent publication prepared by one of your own officials, "Bulletin No. 29," of the Federal Board for Vocational Education.

In our opinion, both from an economic and a moral standpoint the situation of every tuberculous ex-service man, who has successfully completed a course of sanatorium treatment and who is neither totally disabled nor in need of absolute rest, demands that he engage in some form of employment.

In order to cut my remarks as short as possible I am compelled to omit any detailed reference to the various types of sheltered employment which were discussed at considerable length in our report, and will at once proceed to read to you a few extracts from the final report of the Canadian Parliamentary Committee to which I have previously referred.

This report was made to the House of Commons within the last three weeks and was at that time formally adopted by the House, thus providing the necessary statutory authority to enable those responsible to put into effect the principles approved. It was presented by the chairman of the Parliamentary Committee who is himself a Member of Parliament.

As the paragraphs dealing with the after-care of the tuberculous ex-service man pretty well sum up the progress in legislation which has been made in this regard in Canada I will take the liberty of reading to you a few extracts from this report to the Canadian Parliament:

AFTER-CARE OF THE TUBERCULOUS

22. Several representations respecting the after-care of tuberculous ex-soldiers were placed before your committee. A resolution from the Great War Veterans' Association "that a definite scheme for the after-care of the tuberculous be placed in immediate operation," generally covers the subject of all, excepting those having to do with personal representations.

The report of last year stated that a board of five specialists in tuberculosis were investigating this problem and suggested that a definite scheme for after-care, including the coöperation of voluntary organizations, might later be forthcoming.

23. That board, after inspecting the twenty-six sanatoria, and other institutions in Canada, where tuberculous ex-service men are being cared for, and after having made other investigations pertinent to their study of the subject, prepared several reports which were submitted to the Department of Soldiers' Civil Re-Establishment. The last of these, published in December, was placed in the hands of your committee. It is a most comprehensive document, which deals exhaustively with the care and employment of the tuberculous ex-service man, after his discharge from the sanatorium. This report will doubtless take high rank in the medical world. It has served as a basis upon which consideration was given to the subject in hand.

It is recognized by your committee that sanatorium treatment alone and unaided cannot produce the best and most permanent results and that consequently a system of after-care is essential if the results that sanatorium treatment does achieve are to be consolidated.

24. Numerous individual suggestions from various sources were placed before your committee with regard to what should be provided for the after-care of the tuberculous. Certain of these had reference to the provision of an increased pension scale, and a supplementary allowance for the benefit of the tuberculous. Your committee feels that neither of these can be endorsed, in view of the recommendation of other suggestions which make them unnecessary.

It is felt that an adequate minimum pension either for a period of years or permanently is desirable in the case of the tuberculous. This recommendation is limited in its application to ex-service men with a definite diagnosis of tuberculosis based on approved standards.

25. It has been demonstrated to the satisfaction of your committee that the majority of tuberculous ex-service men will require skilled medical advice and supervision for as long as they live. This supervision should be available for tuberculous pensioners as well as out-patients of the Department of Soldiers' Civil Re-Establishment which will necessitate an extension of the present facilities in the way of clinics and personnel designed for this purpose.

26. One of the great difficulties in dealing with the scourge of tuberculosis has been the scarcity of medical experts and the absence of facilities for properly training those members of the profession who desire to qualify in this respect. The same condition exists with regard to the nursing staff. Complaint on the above heads has been voiced to previous committees and was again brought to the attention of your committee.

The next paragraph makes a suggestion whereby a selected sanatorium

is to be given assistance to enable it to afford special instruction to physicians in differential diagnosis and treatment.

28. It has been impressed upon your committee that on therapeutic, economic and moral grounds, every ex-sanatorium patient who is even partially fit should be suitably employed. Opportunities for suitable employment available to the average type of ex-sanatorium patient are extremely rare in the ordinary labor and industrial markets. Philanthropists occasionally employ a few, but for the majority, opportunities for sheltered employment are only available if artificially created. Accordingly there is a real justification for the inclusion of sheltered employment in any well-balanced system of post-sanatorium care of the tuberculous.

29. It has been urged and your committee agrees that the provision of sheltered employment for the tuberculous should be in the hands of some approved non-Governmental agency. The state, should, however, recognize its responsibility to the ex-service tuberculous patient by initiating sheltered employment and by offering the financial assistance required for the establishment of industries and for the medical supervision of the patients. Your committee recommends that the Department be authorized to conduct a survey of the tuberculous ex-service men residing in all the large Canadian cities, and to take the necessary steps to establish a sub-standard shop to train and employ tuberculous ex-service men in any city, where the result of the survey appears to warrant it, and where an approved non-Governmental agency is available for its administration.

30. It would appear that a purely agricultural colony for the tuberculous has such narrow limits of usefulness in this country as not to warrant its establishment. Your committee agrees, however, that an industrial colony on an experimental basis warrants trial in Canada in a carefully selected location. The proposal submitted from patients at the Mountain Sanatorium, Hamilton, in this connection is worthy of most careful investigation and consideration, with a view to the provision of the necessary financial assistance, to establish industries and provide competent medical supervision under the Department of Soldiers' Civil Re-Establishment. As a permanent community or village settlement for the tuberculous is the logical complement of the training colony, it may ultimately develop from it.

It may be seen from what I have read that the Parliamentary Committee has recommended to the House the provision of a minimum pension; the extension in the way of clinics and personnel necessary for the skilled medical supervision of the tuberculous; an increase in the opportunities for special instruction of medical men in tuberculosis work; the recognition of the need of providing opportunities for the sheltered employment of the tuberculous in sub-standard shops and the necessary assistance to enable a colony experiment to be tried.

The approval of this report, which was given by the House, renders possible the translation of these recommendations into action through the medium of the usual statutory channels.

THE SANATORIUM CARE OF TUBERCULOUS SOLDIERS BY THE FEDERAL GOVERNMENT*

By George Thomas Palmer, M.D.

Springfield, Ill.

AND

Henry W. Hoagland, M.D.

La Jolla, Cal.

Early in the World War there were brought to us from overseas reports of the prevalence of tuberculosis in the military forces and in the civil population which caused the tuberculosis war problem to assume staggering proportions. These first reports were doubtless exaggerated. At any rate, they were sufficiently inaccurate to cause the pendulum of medical opinion to swing backward in its characteristic fashon, and there were found those who minimized the importance of tuberculosis in its connection with the war until it apparently ceased to be a problem of any considerable magnitude. In fact, some of the articles published at that time gave one the impression that military service would prove beneficial rather than hurtful to the man with dormant tuberculosis.

Be that as it may, we find ourselves at the present time possessed of sufficient evidence to justify the conclusion that after all others, save one, of the medical problems of the war have been satisfactorily settled, tuberculosis will remain the paramont problem of the government, whose solution will not be reached for two decades at least. The other problem will be that of the proper care of nervous and mental cases.

The incidence of tuberculosis as the result of the war cannot as yet be determined. It is certain, however, that the maximum has not been attained, and it is asserted by those who have given the subject serious consideration, that the peak will not be reached for a number of years to come.

The war-time tuberculosis problem of the United States may not be the staggering thing at one time anticipated. It has been sufficiently big, however, for the Nation to have been proven incapable of meeting the situation. Neither in hospitals, sanatoria, nursing service nor compe-

* In the absence of the authors the paper was read by Dr. David R. Lyman, who with Dr. Palmer, Dr. Hoagland, Dr. Martin F. Sloan and Dr. Victor F. Cullen, was a member of the committee selected by the Surgeon General, U. S. Public Health Service, to study Government tuberculosis sanatoria.

tent medical personnel were we prepared for the great increase in recognized tuberculosis among our soldiers, sailors, marines and nurses, and, if the truth be known, we are not yet prepared to meet our war-time emergencies. Possibly it would have been better for us had we remained gravely concerned, as we were by the first exaggerated reports from overseas. It is quite likely that the conservatism or optimism, causing the backward swing of the pendulum, has been partly responsible for our lack of preparation, and has cost many human lives.

Before we were fairly engaged in the war, scores of young men, unfortunately passed in the selective draft, although definitely tuberculous, were coming back to their home communities, in many states, to find inadequate sanatorium provisions and, in not infrequent instances, to die in the almshouses. Before any other agencies were functioning, be it said to its credit, the National Tuberculosis Association had assumed its war-time responsibility of caring for these unfortunates and, in many states, the state and local tuberculosis associations secured the means for institutional care and relief which otherwise would have been unprovided.

Until the signing of the armistice, the policy generally prevailed of retaining the tuberculous individual in service and in caring for him in army and navy hospitals; but after the signing of the armistice, and with the outside influence brought to bear to obtain the discharge of patients regardless of their physical condition and welfare, it became evident that this policy must be abandoned. From that time until the present, with promise of perpetuation into the future, political and other outside influences have been the greatest obstacle to the Federal Government in doing its full duty to its sick men.

With the wholesale discharge of tuberculous persons from military service and from army and navy hospitals, it became necessary to develop an enormous machinery, including hospitals, sanatoria, dispensaries and medical service to care for returned soldiers upon their voluntary application for such care.

Something over two years ago this gigantic task was imposed upon the United States Public Health Service. The Public Health Service is accustomed to emergencies, but this was one for which it was quite unprepared both in institutions and in technical personnel. The old marine hospitals had been permitted to fall into a condition of comparative disuse and some of them had been abandoned. The temporary military hospitals, turned over to the Service, were, for the most part, unsuited for the proper care of tuberculous persons. In many instances, when these institutions were taken over, it was found that the equipment was hopelessly inadequate and, for a time, supplies and new equipment were seriously delayed or were quite unobtainable.

Regardless of the character of government-owned institutions, their bed capacity was entirely insufficient and it became necessary for the Public Health Service to enter into contracts or agreements with existing private and public sanatoria for the care of tuberculous persons.

This contract service has given rise to a great deal of controversy and discussion. After a rather careful study of facts, I believe we may say that the average service rendered by contract hospitals has been reasonably satisfactory. The shortage of beds throughout the Nation made careful discrimination in the selection of institutions impossible. Many of the private sanatoria of the higher class have accepted government patients at considerable sacrifice, in money as well as in institutional morale, cheerfully made in a patriotic spirit, and it is certain that these institutions have given better service than can ever be expected from the large government-owned sanatoria.

It was necessary, however, to utilize beds in some private institutions whose standards are not so high, and it was unfortunately also necessary to place patients in institutions designed for the care of paupers and destitute persons. Regardless of the character of service afforded by these institutions, the stigma of the so-called "charity institution" made it impossible for them to be in any way acceptable.

In undertaking its great task of the hospitalization and care of returned soldiers, the Public Health Service apparently fully recognized its unpreparedness and further recognized that the tuberculosis problem would be, perhaps, the most difficult it would have to encounter. The Surgeon General and an efficient Chief of the Tuberculosis Section, with unusual breadth of vision, were not only receptive of constructive criticism, but unhesitatingly sought what they regarded as authoritative guidance. As a result of numerous conferences with a special committee of the National Tuberculosis Association, five physicians were selected to visit and inspect the existing government sanatoria, and to recommend changes and corrections contemplated to bring about better methods of diagnosis, care and treatment. The writers were selected in this group, together with Dr. David R. Lyman, of Connecticut, and Dr. Victor F. Cullen and Dr. Martin F. Sloan, of Maryland. To Dr. Lyman, Dr. Cullen and Dr. Sloan were assigned the tuberculosis sanatoria and the tuberculosis divisions of general hospitals throughout the eastern and southeastern sections of the country, while the writers were asked to make studies of the hospitals at Fort Bayard and Fort Stanton, New Mexico; Prescott, Arizona; Palo Alto and Camp Kearney, California; Tacoma, Washington; Houston, Texas; Alexandria, Louisiana; Evansville, Indiana, and St. Louis, Missouri.

While it cannot be denied that there were many conditions found in these institutions subject to criticism, we ourselves returned from our inspections with our chief impression one of admiration for the efficient manner in which the Public Health Service has met its tremendous obligation in the face of many serious difficulties, and we are satisfied that this impression is shared by the other members of the inspection committee and must likewise be entertained by any fair-minded person whose opinion is based upon actual knowledge of facts rather than upon sensational rumors and irresponsible misstatements.

The members of the committee were asked to remain in each institu-

tion long enough to become acquainted with the members of the medical and nursing personnel; to familiarize themselves with the methods employed in diagnosis and treatment and to obtain definite knowledge as to discipline, food, amusements and diversions of the patients and the application of special diagnostic and therapeutic procedures. They were asked to direct their attention particularly to institutional operation and management, devoting themselves to buildings and physical equipment only so far as these might affect the medical service and the care and welfare of patients. Physical property is frequently inspected by the regular inspectors of the government.

One of the most serious obstacles in the operation of government sanatoria is the scarcity of physicians and nurses specially trained in tuberculosis. It is asserted by the American Sanatorium Association that the medical and nursing services are three times as important as climate, site, buildings and equipment. The United States Public Health Service has doubtless had occasion to verify the truth of this assertion.

In times past, medical colleges have stubbornly neglected the diagnosis and treatment of tuberculosis in their curricula, and the vast majority of nurses have been graduated from their training schools without having had the slightest instruction relative to this disease, with the result that there has not been a sufficient specially trained medical and nursing personnel to meet even the normal needs of our civil population.

Theoretically, many of the government sanatoria are too large to attain the maximum of service for the individual patient, six of them ranging in capacity from 500 to 1000 beds. On account of the shortage of medical personnel, it has been found impossible to secure entirely satisfactory commanding officers and chiefs of medical service for all of the existing institutions, and it would be out of the question to man satisfactorily a large number of hospitals of smaller bed capacity. To overcome the disadvantages of the large institution as far as possible, and to give the patient that personal contact with his physician essential to the best results, the Public Health Service is striving to make the ward surgeon the administrative and medical head of his own ward, so far as this may be practicable, thereby creating within each large institution a considerable number of units, constituting, in fact, small individual sanatoria, whose successful operation will depend, in a large measure, upon the intelligence, efficiency and personality of the ward surgeon.

It is the earnest desire of the Public Health Service and of the Assistant Secretary of the Treasury, Colonel Edward Clifford, under whose jurisdiction all of the activities for the care of soldiers are now centered, to operate government sanatoria in such a manner that they may be entirely above criticism. To accomplish this desirable end, the physicians who made studies of government sanatoria have recognized that a number of basic faults will have to be overcome and that there will have to be modifications and changes in a great many details. In the attainment of this end, much may be done by the Public Health Service itself, but much will also have to be done in the creation of public

sentiment which will eliminate those conditions over which the Public Health Service now has little or no control.

A satisfactory medical and nursing service will have to be developed by the government through the education and instruction of such physicians and nurses as are available. This is being done in most of the institutions through classes of instruction which are usually being intelligently conducted.

The nursing service will have to be improved by a little closer coöperation between the medical and nursing staffs and by the provision of better living conditions and more amusements and diversions, especially in the more isolated posts, whereby there may be overcome the pernicious social relationship between patients and nurses, which was found to be a demoralizing factor in most of the institutions inspected. If the present shortage of graduate nurses of the better class cannot be overcome, it will be necessary for the government to train female attendants as is done in most of the private sanatoria.

The most serious fault in these government sanatoria, and one which will be overcome only with the greatest difficulty, if at all, is the flagrant lack of discipline to be observed in practically all of the institutions. This is recognized by the more intelligent and serious-minded patients as a distinct bar to their recovery. The patients generally are restive of restraint. They claim to be tired of military discipline and, on this account, it is possible that the uniforms and military titles of the medical staff serve as an irritant. There is considerable gambling. In most of the institutions, the use of liquor and of narcotic drugs is not unknown, while the use of tobacco and especially of cigarettes, which seems to have been made a cardinal virtue during the war, is generally excessive. The patients apparently fail to recognize that reasonable discipline is an essential part of the treatment of tuberculosis, and seem to regard all disciplinary efforts as an arbitrary and offensive use of authority.

It was the opinion of each member of the inspecting committee that the men are being distinctly harmed by the possession of an excessive amount of money, derived from federal compensation, and it was recommended that some legislative action be taken by Congress whereby compensation funds may be turned over to the members of the soldiers' families or accumulated with interest until the soldier is discharged from the sanatorium. In our opinion, it is only through some such action that the demoralization of discipline can be overcome and, even then, that type of discipline essential to the well ordered sanatorium, and the recovery of the patient, will not be obtained unless public opinion can be in some way aroused to eliminate the well-intentioned, but misdirected, outside interference of politicians and others. So long as these restive and restless patients feel that their insubordination and hurtful indiscretions are condoned, and so long as the authority of the institutional heads is over-ridden by powerful political influence, government sanatoria will fail to measure up to any sort of high standards and will fail to compare favorably with well conducted private institutions.

It is impossible at this time to go into detail in regard to these government sanatoria; but the great problems which will require the utmost effort on the part of the Service are the attainment of the necessary institutional discipline and the building up of the medical and nursing personnel.

Inasmuch as the problem of caring for the returned tuberculous soldier will confront the Federal Government for perhaps twenty years to come, and, inasmuch as it will be necessary for the Public Health Service and the Bureau of War Risk Insurance to educate institutional physicians, medical examiners and nurses, if returned service men are to receive the type of care to which they are entitled, an educational machinery must be created by the government and it appears that this machinery can be utilized not only to meet the government's needs, but in the elevation of professional standards throughout the nation.

If every physician and every nurse connected with the government sanatoria is required to become proficient through special training and instruction, there will ultimately be available a large group of doctors and nurses who will find ready employment and who will be exceedingly valuable in the many county and municipal sanatoria which are being established in all parts of the country through the influence of the war.

The Bureau of War Risk Insurance now has in every county and parish in the United States at least one medical examiner with a large number of acting assistant surgeons responsible for the medical care of soldiers. For the most part, this gigantic staff is entirely untrained in tuberculosis, but the Public Health Service has already created classes of instruction in the diagnosis and treatment of tuberculosis for its representatives, and these schools are now being taken over and operated by the Bureau of War Risk Insurance. While the courses are necessarily brief, the carrying out of the plan will result in our having in each county in the nation at least one physician who has given some serious thought and some study to the modern conception of tuberculosis.

In many of these schools, it has been found that private physicians, in no way connected with the public service, are making applications for admission. Inasmuch as the United States Public Health Service is primarily interested in the prevention and suppression of disease in the civil population, it is believed that these classes can be made tremendously valuable by becoming permanent teaching centers available to all physicians.

It also appears possible in the future to utilize the government sanatoria now in operation or under construction, and especially those situated near the large centers of population, as more pretentious schools for larger courses of instruction similar to the private schools now operated at Saranac Lake and at Colorado Springs.

The development of this educational service in tuberculosis will not only tend toward the betterment of tuberculosis practice throughout the entire nation, but will stimulate interest in and about government sana-

toria in such manner as to guarantee to the tuberculous soldiers of the country an infinitely better type of medical service and institutional care than they are receiving at the present time.

DISCUSSION ON PAPER BY DR. PALMER AND DR. HOAGLAND

Dr. Lyman: I have only one or two words that I can add. I think the feeling that all five of us brought back from the field was the feeling of a very critical problem. Dr. Palmer has brought out in his paper chiefly two things. We need to have a trained medical personnel including nurses, and we need to have some proper means of maintaining a disciplinary régime in the sanatoria. There is a third thing and that is we need to get clear of the hysteria on the subject.

Dr. Palmer brought this out very clearly in discussing this point with a man who had in a speech, outlined one of these cases of individual hardship where the individual's case was lost in the big mass of detail in the War Risk Bureau and the handling of his compensation had been delayed and the man had died, with his wife working in a laundry to support him. He died cursing the Government for neglect, so the speaker said, and the next day the compensation check came in. Dr. Palmer's reply to that was very good and was made to that individual off stage. He said, "What you said is undoubtedly true, but if I followed you on the stage and gave the details of the service cases here and there that I know about and what individuals among the service boys in the hospitals have done, it would be just as true as what you have said. It would give a true picture as far as it went, but it would not be fair to the service men, any more than your picture is fair to the Government, so let's get away from hysteria and get down to basic facts." I think that is one of the big things that needs to be done.

The United States Public Health Service was presented with a tremendous job in regard to equipment, for in the all-wise way of handling Government affairs, when the army turned over a hospital to the Public Health Service, in one instance that I know about, it even went so far as to strip the plumbing out of the building and take it along. It usually took everything and left the bare building, but in this instance it took all the plumbing and just left the frame of the building for the other Government service to operate in. The general trend of the Public Health Service and the work of the men at the top deserves every bit of support we can give them—every bit.

When we came back to Washington we told Dr. Smith that we didn't see how they could hold men under the obstacles they are working against with the equipment given them. We couldn't do it in civilian life and the only answer is that through some of the heads of the Service you have the spirit of service to the country, the same that prevailed through the war. If you stop somebody, whose aunt has a "no-account" boy in the medical profession at home who can't make a living, from getting rid of

him by using political influence to get him into the Public Health Service or any Government service, you will be of real assistance to the work.

In December we recommended the immediate cancellation, the immediate disruption of the Government hospital at Greenville because, apparently, the facilities were so utterly inadequate that it didn't seem that anything could be done with it, but six months later, with a staff, mostly untrained, but with an officer who understood real tuberculosis work and a commanding officer who understood men and could stand on his own two legs, they have brought that place up to a point where I would seriously suggest it as a training center to teach people how to run such a place. That shows what the Service can do — when they have real men to put over the work.

There is one thing in which we must back up the Service, and that is the control over these boys. That is something we must do for the Service all over the country, and if we do that, they can work out the other problems, but if we don't, they can never work out anything, especially in face of all the criticisms that the Service is subjected to here and there. I should hate to have anyone come and criticize me and turn me inside out and bring all these little matters up before the public. In a case like that I would rather they should see my institution from the outside than the inside. If we can bring proper support to the Service, then we are going to work through this thing; if not, then we are just going to struggle through and make a failure of it.

Dr. Charles L. Minor, Asheville, N. C.: I am in a position where I can talk to officers and men in a large Public Health Service Hospital. The treatment of tuberculosis consists fundamentally in a reaction of personality on the individual and under the present existing governmental ideas, it is impossible to get the reaction of that personality on the individual. Under the present conditions it is impossible for the Government to treat tuberculosis as such men as Dr. Lyman treat the patients in their sanatoria. When the Government will put a hospital in the hands of a man with absolute power to control that institution, the difficulties with discipline are going to disappear. Discipline does not come from fear. Discipline comes from love. Suppose you have an officer in charge of a hospital who understands the patients and their cases and whom the patients trust, and the next morning the men wake up and he has been transferred and someone else is there who doesn't understand the men or their cases. It is useless to suggest discipline or the proper carrying out of discipline unless the Government will change its methods. There is a great big machine that grinds just so. It is not in the least the fault of Dr. Smith, but you have got to cut that red tape so that the Government doctors can go ahead and do their work.

It is difficult to handle one or two thousand cases at once but that difficulty can be overcome by having the patients in units of 100 or 50 to be handled by one officer who can learn to get close to them, know them and handle them properly. You can handle two thousand men or ten thousand men in this way. Perhaps that is a question of getting the right sort of

doctors. We all know that this is difficult but that can be met by degrees, first by tuberculosis hospital training and then by men so trained becoming doctors in, and finally superintendents of, the institutions. They must be men of force and personality. They must be taught to study tuberculosis and to study their cases.

The success of any task depends upon the men who direct it, and to succeed you have got to have them, and if you want to hold them you have got to expect and allow a reasonable expense and provide them with proper equipment, but if they have to wait every time for permission from a medical board or a congressional committee or that sort of thing, they are hopelessly handicapped.

In view of bureaucratic inertia and resistance which apparently cannot be gotten rid of, I see very little outlook, but if a good man could be given a free hand to pick his staff and run the place as science had taught him, our Government hospitals could be transformed and made first class.

Dr. John W. Turner, Washington, D. C.: Our chief, Mr. Uel W. Lamkin, on Tuesday night spoke on the general tuberculosis problem of the Federal Board. I believe that a more detailed discussion of the special training centers that have been established by the board at Nauvoo, Pascagoula, Pocono Pines, Waynesville and San Antonio will be apropos.

Any comprehensive plan for the rehabilitation of those wounded by tuberculosis in the Great War must be founded on sound economic and pedagogical principles, on a thorough knowledge of tuberculosis, the mode of its development, the manner and rate of its healing during convalescence, and the psychology and physiology of the inactive case.

The basic principles of rehabilitation apply. There is a disability. The vocational handicap of the disability must be removed, and the disabled must be returned to a gainful occupation. But in pulmonary tuberculosis the disability is not merely a mechanical one, where the nature of the handicap is clear and well defined. It is dual in nature, mechanical and hazard. The lungs have been restored in part by nature, but never again will they function as human bellows able to do their full part. As we have said, the disability is only partly mechanical; there is also the factor of health hazard. The inactive tuberculous case is in a condition of unstable equilibrium and until this condition has become well stabilized must beware of another breakdown.

His convalescence is long and tedious. It may be divided into two parts — physical and industrial. In the hospital the Federal Board provides training adjusted by medical prescription to the man's physical condition. Ideally, this condition should continue, but because of a shortage of sanatorium and hospital beds for the tuberculous, the period of physical convalescence in the sanatorium must be shortened. Its purpose is considered fulfilled when it has established health to the point where the patient is able to carry on an existence of dreamy ease. But when the patient attempts to function as a machine for the liberation of sufficient mechanical energy to carry a *full course* of study or earn a livelihood, he is weighed in the balances and found wanting. It is imperative that on

discharge his training, started in the sanatorium, be continued according to his physical capacity under medical supervision until his physical convalescence has passed well along into industrial convalescence, a period that ends three or four years after active disease has passed into the inactive stage.

Training under medical supervision means limited training. It means that the trainee's health comes first, and instruction second. The usual school does not readily adapt itself to such a program. Furthermore, the tuberculosis trainees of the Federal Board are a special pedagogical problem. The men differ in age, in habits of study, in intellectual content, and in outlook on life, as well as in energy-producing capacity, from the other students. It is neither scientific in principle nor feasible in practice to train the groups together. A special school for the tuberculous is the logical solution to the problem. In the special school it is possible to provide the proper atmosphere; the psychology of the group can be made a favorable factor. In short, the rationale of the special school is predicated on a profound knowledge of tuberculosis, its tendency to recur until it has been well stabilized by long periods of healing, an appreciation of the frailty of human nature and its need for medical guidance, and the favorable influence of a helpful environment.

The discussion of the content and technique of the training of the tuberculous is a pedagogical one, but there are certain general principles, physiological and psychological, which should be considered. For the tuberculous rehabilitation means spiritual as well as physical or economic restoration, cultural as well as utilitarian attainments. It is more than soporific job placement. The rehabilitation training should be fundamental and efficient, and in accordance with the intellectual and physical capacity of the trainees.

The average trainee has a rather narrow industrial horizon. His knowledge and information of labor, industry, and commerce must be widened and broadened. To accomplish this a definite course in vocational opportunities is needed. While his occupational horizon is being widened, a course in physiology and hygiene lays the foundation for a rational choice of a vocation as well as teaches the essentials of health. It teaches the man to think of his body as a machine and imparts to him knowledge that will enable him to care for that machine. Real vocational guidance is predicated on such a background. With such a background the employment objective can be intelligently chosen with a reasonable probability of success after rehabilitation.

The function of the special school for the tuberculous may be summed up as follows:

First. It prepares the tuberculous for real scientific vocational guidance, and fortifies him against a breakdown, by a course in physiology, hygiene, and job opportunities.

Second. It adjusts the training to the man during the early critical period of his convalescence out of the hospital by providing the right environment and medical supervision.

Third. Its purpose and function have been completed when the health of the trainee has been stabilized to the point where he can carry on with a more limited medical supervision.

THE CARE OF TUBERCULOUS EX-SERVICE MEN: A CORRELATION OF LOCAL AND PUBLIC HEALTH SERVICE WORK

By C. Howard Marcy, M.D.

Pittsburgh

The care of the tuberculous ex-service man since demobilization of our army and navy is a problem which has taxed the resources of both the federal and civil agencies. New organizations, additional personnel and increased hospital facilities have become necessary because of increased demands made on communities. The size of the task and the complexity of the problems are probably not fully appreciated by those not actively engaged in the work. For the necessary classification of these men, the difficulties encountered are much greater and more numerous than those encountered in the usual routine care of civilian patients. Factors such as compensation, unemployment during the recent labor depression, the many vague pulmonary symptoms, some real and many probably imaginary, attributed to the effect of gas, have minimized the value of our medical history and added greatly to the difficulties of accurate diagnosis and prognosis. Another problem of equal importance has been the provision of proper hospital care, the treatment of out-patients, and the rehabilitation of the convalescent and part-time man.

As attending consultant in tuberculosis for the United States Marine Hospital No. 15, an opportunity was afforded to study this work for the past fifteen months in the Pittsburgh district. A knowledge of some of the problems from the point of view of the local examiner may be of value in the construction of the complicated machinery necessary to provide adequate care for our disabled soldiers and sailors.

In the beginning, the work was handicapped by our distance from the source of authority. Unavoidable delays in receiving permission to admit to hospital or have x-ray or special laboratory work done caused much inconvenience, loss of time and in some instances actual hardship to the patient. Necessary beds for immediate hospitalization of tuberculous patients were not available and recourse had to be made to the already burdened state institutions.

The rapid increase in number of applicants for compensation soon made apparent the necessity of either building up a complete organization of our own or affiliating with some local organization which could supply our needs; namely, physicians trained in tuberculosis work,

efficient district nursing and social service, adequate laboratory and x-ray facilities, and a sufficient number of beds immediately available for observation and treatment of patients. Since it was evident that the basic organization necessary for a large part of the work was no different than that required in handling civilian groups, affiliation with a local organization was considered the more practical plan and the one which could the more rapidly be put into operation.

In a conference with the chief of the tuberculosis section of the United States Public Health Service, the authorities of the Tuberculosis League Hospital of Pittsburgh and the commanding officer of the United States Marine Hospital No. 15, an agreement was reached by which all the tuberculosis work of the Public Health Service in the Pittsburgh district was to be done at the Tuberculosis League Hospital, under the administration of the commanding officer of the Marine Hospital. In other words, the arrangement made a special tuberculosis department for the Marine Hospital from a local organization which had been in existence in Pittsburgh for fifteen years, and was already equipped to supply all of our needs.

The only additional personnel necessary for the Public Health Service to provide was one physician and one nurse as correlating agents between the two hospitals. Very little adjustment of the local machinery was necessary to begin at once the additional work of caring for the ex-service men. Thirty beds were set aside by the Tuberculosis League Hospital for the exclusive use of ex-service men. Twenty of these for ambulatory patients are now in a new forty thousand dollar pavilion, recently built on the hospital ground by public subscription, and ten for advanced patients are in the main building.

The consultant in tuberculosis for the Marine Hospital, under the new arrangement, is located at the Tuberculosis League Hospital and works with members of the staff, so that all government cases have the benefit of the diagnostic facilities afforded by the institution. He is also in daily touch with government cases in the hospital for treatment and observation and can control all admissions and discharges.

A visiting nurse, provided by the United States Public Health Nursing Service, visits all patients in their homes. It has been possible by also using the visiting nursing service of the Tuberculosis League Hospital to have frequent visits made where bedside care was necessary. Accurate and complete records of these visits are at all times available for the information of the examining physician.

We have found that a local institution within easy reach of family and friends, even without the best climatic conditions, has been essential in our work. The advice to go away for treatment was too frequently given by physicians and friends, without due consideration of all social problems involved. Many of these men who were sent to more favorable climates became homesick and left before their disease was arrested, and are now back seeking admission to local hospitals. This is only natural, as numbers of these men had been in the service for one or

two years before they became ill and resented being separated from their families for prolonged treatment.

An analysis of our first thousand examinations, covering a period of approximately fifteen months beginning in February, 1920, gives us a fair idea of the equipment necessary to carry on the work in a given locality such as Pittsburgh. It is not my intention to discuss problems of differential diagnosis in this paper. All patients have been put through as careful a routine as time and circumstances would permit. They constitute a selected group. All had been previously examined by United States Public Health Service physicians and were referred for special chest examinations because of suggestive pulmonary signs and symptoms. Out of the 1000 examinations made, the lungs were found clinically negative in 414; pulmonary tuberculosis, either active, quiescent or apparently arrested, was present in 236; chronic bronchitis, in most instances post-gas in origin, was found in 145; healed empyema in 49; a miscellaneous diagnosis of various acute and chronic non-tuberculous lesions of the lungs was made in 115, while 41 tuberculosis suspects are as yet undiagnosed. Of the 236 tuberculosis patients, 138 were active cases needing institutional treatment and the remaining 98 were cared for in their homes. It is interesting to note that of the 136 institutional cases, 89 have been treated in the Tuberculosis League Hospital, 12 were sent to other Pennsylvania institutions near Pittsburgh, 26 were referred to the United States Public Health Service hospitals in North Carolina, New Mexico and Colorado, and 11 refused government care and left the city at their own expense. Of the 98 home patients, 78 are quiescent or apparently arrested and most of them are doing light work or attending vocation school; the other 20 are still continuing treatment at home, having left different hospitals against advice or were returned by institutions as cases of total permanent disability.

The result of our first fifteen months' work has been very gratifying. Its success has depended upon two things: first the decentralizing of authority, which permitted the local agents who come in daily contact with the patients to proceed as they think best, and second, upon the generous coöperation of the local organization in carrying out efficiently the care advised by the examining physician. It is believed that during this period all the tuberculous cases or suspected cases applying for help in a district drawing from a population of nearly one million people, have passed through our hands, and to date every man, so far as we know, desiring or needing institutional treatment has been satisfactorily placed, and all those not needing institutional treatment are under constant observation as out-patients with visiting nursing care in their homes.

WHEN IS AN EXHIBIT?

By E. G. Routzahn

New York

This is a sad but joyous occasion for me.

I have expressed my emotions on exhibits through impassioned pleas and ponderous discussion, and yet people still think of me as a walking propagandist for doing everything and saying everything through exhibit forms.

Having failed to convince more than the few what I think of exhibits for selected use and only when they will better serve than some other form, and that they can be useful only when they are part of a plan of campaign — having failed in getting this over, I was glad to accept the invitation of our honored and youthful secretary to see if we can find some fun in what we call exhibits.

This is more or less a patch work — a crazy patch work you may decide before I am through. Besides Mrs. Routzahn six others in our office have contributed the bright ideas — so whenever you wonder that I should have thought of it, you will be safe in placing the responsibility on one of my collaborators.

When is an exhibit? Well, I should say that it is really an exhibit several months, perhaps six months, before the show is to come off. At that time it is in the tuberculosis secretary's head and it is really a wonderful affair. It is the best exhibit that has ever been made on the subject. Crowds jam the aisles. It is an event to be remembered. It is colorful and absorbing, informing and inspiring.

Along about two weeks before the event is to come off terrible things have happened to this exhibit and I am not sure it is an exhibit at all now. All sorts of unexpected routine duties that regularly take the secretary's time have intervened and so at this stage he is madly seeking a sign writer and cutting up some of his leaflet material to be enlarged into placard forms, gathering up his photographs, etc. When is an exhibit? At least *that* exhibit was all over six months ago when the secretary laid aside for the time being his beautiful dreams.

But really now, when is an exhibit? Perhaps it is when Dad and Mother and Mary and Willie going along the aisles of the exposition, or on the fair grounds, or past a vacant store in the street, all of them on their way to some great event like the circus or the side-show, are drawn irresistibly to that tuberculosis display. Dad says, "Wait a minute, I want to hear what that man is saying." Or Mother says, "I want to see

what that lady is doing." Or Willie says, "Oh, see all those things moving up and down." Or Mary says, "What beautiful colors. I want to see what's there." Then it may be that it is an exhibit — but maybe it is not. Perhaps after their attention has been caught they are disappointed. Dad says, "Oh, he is just talking some high-brow stuff;" or Mother says, "She is not making anything that I could do at home;" or Mary says, "Those nice colors were just some decorations and all the rest were words."

When is an exhibit? It is probably an exhibit when Dad will stay for five minutes until the man finishes what he has to say, or when Mother waits to ask the lady a question. It begins to be hopeful that it really is an exhibit when a family goes off saying, "You know there is something in it. I would like to know more about it." Still, I am not even now at all sure it is an exhibit. We really cannot tell until the next day or perhaps the next week. We'll really know when Dad begins paying out good money for fly screens, or an extra quart of milk a day, or when Mother racks her brains over balanced meals and comes out triumphantly with an appetizing vegetable added to the dinner and meat cut down occasionally, or when Mary says, "I want a pair of those good-looking, low-heel shoes," and when Willie asks for a new tooth brush, and perhaps even uses it (but of course we do not want to ask too much of an exhibit).

Just when did this exhibit happen? I think it hasn't been pulled off yet, but maybe it is going to be shown in one of the county fairs — maybe a half dozen of them, this summer.

I haven't felt satisfied altogether with any of these answers to the question, "When is an exhibit?" So I went to the laboratory of one of the great modern Decide-Everything-By-Questionnaire Wizards, asking him for a series of questions he would give to applicants. Mr. Edison said:

"Tell me what an exhibit does and then I will give you the questions to qualify you for a job."

Upon my reply that an exhibit must

(1) Attract attention;
(2) Secure reading or examination;
(3) Awaken interest;
(4) Get action.

Mr. Edison said: "I get you. Here are the questions:"

Should an exhibit be worked up with the idea of getting something across? Give the advantages of such an effort, and its disadvantages.

Assuming that it is worth while to have an exhibit, is it worth while to consider making the exhibit worth while?

If you wish to show the comparative death rate from ten diseases most popular with health workers would you have bars set up vertically or horizontally? What tuberculosis exhibitors would you put behind the bars and for how long?

If you wish to get a community to support public health nurses would you display a large crayon portrait of a group of tubercle bacilli beautifully mounted, or a group of tuberculosis nurses?

If you wish to bring people to a clinic to be examined would you display ten reasons why the experience is a disagreeable one, or twenty?

What is the best color scheme for presenting reasons for a health examination to people who do not reason?

What sign writer first sold tuberculosis workers on the idea of hand lettering their pamphlets and spreading them out on walls instead of printing them? What punishment does he deserve and will he get it?

Is an exhibitor made or born, and how do they get that way?

Is there any danger that the exhibit will get the desired ideas over? If so, how can this be avoided?

Is it desirable for those working up an exhibit to know what it is about? If not, why not, and if so, why, and if not so, why not?

Which should receive more attention, the exhibit or the exhibitor?

Should a motion picture on tuberculosis have five reels or ten, and how fast should it be reeled?

If it is discovered that the audience knows something about the subject of the exhibit should the audience or the exhibit be changed?

Do you get an exhibit just because you want one or because you "ought to have one" or because every one is doing it?

When more than 50 per cent. of the children in a schoolroom cannot see the words on a poster, should the poster be enlarged or should the children be supplied with spectacles?

When a plan or an idea or samples of exhibit material are submitted for "criticism" how can we determine if that means criticism or commendation?

Which of these psychological appeals is the best to use in an exhibit with a positive health message (and by the way, what is a positive health message)?

> The gambling instinct (for example, if you arouse the sporting instinct by offering 20 to 1 odds on escaping tb. are you liable to arrest?).
>
> Fear (for example, fear of getting your name on a health department's mailing list if you sign the book at the exhibit).
>
> Mother love (for example, in getting mother to have Willie wash behind his ears).
>
> Obedience (for example, an appeal to the wide-spread instinct of Americans to react favorably to a list of 57 don'ts).
>
> Pride (for example, a desire to weigh more than your neighbor or to have more tb. cases on the map of your state than for the one just west of you).

Is the so-called "public" more interested in reading tuberculosis propaganda than are those who are engaged in the game?

When what is known as an exhibit is not interesting enough to be read by the blasé tuberculosis secretary in whose office it is hung is it likely that the blasé "public" will read it?

But perhaps I can best answer the question "Why is an exhibit?" by

showing you an exhibit in the making. On this large sheet is a poster containing the life history of Madame Fly. On the left is a history in ten or twelve chapters in which Madame Fly is the winner of the race, and the baby the loser. On the right is another serial story in which the baby wins and Madame Fly loses. At the top is a good title for the series, and then a sub-title. Below this is the symbol of a fly campaign, namely, the fly swatter, and on very close examination you can read repeated several times the slogan "Destroy their breeding places." One of the state departments of health has done a fine piece of work in getting together these striking ideas and illustrations which are a basis for a wide diversity of exhibit forms. This material has been used throughout one state in its present form of a poster and doubtless has accomplished great good. Its chief interest for us, however, is that here we have assembled in convenient form to work on all the material for a complete exhibit. Here is the idea dramatized, working sketches and excellent captions.

The inconvenient thing is that it is all put together on one sheet and I have to cut it up, but you'll have patience while I cut it into about twenty parts.

Having done that, let's see how the different folks we know might make an exhibit of it.

Oklahoma Schevitz is going to make up a set of posters, with the fly so vividly colored that it fairly stands out from the poster.

Pa Minnick will get up a series of car cards competing in color with the posters from Oklahoma. He will place the swatter horizontally, may even use a bit of real wire, and display this card between the two groups entitled "Fly Wins" and "Baby Wins." Pa Minnick will probably have another idea and put these pictures and captions on post cards and mail them out once a week from the first of April to the first of July.

Suppose we turn this material over to Dr. Drake. He will probably make the fly wink its eye as it lands on the baby's bottle, and will have a collection of flies behind screens labeled "the most dangerous birds found in Illinois." Then he will have a wonderful array of working models. That takes a good deal of ingenuity or some money, or both, and so the only way we can do that is to pool our funds and to have someone make it up in duplicate form as a loan exhibit for all of us. (As a matter of fact why not do this whatever form we put it in?)

Up in Wisconsin they will make it up into a panorama with the trail of death revealed as the story stretches across the canvas, with plenty of human interest detail, and providing good talking points for the itinerant educator who wanders through the country-side.

Let's hand the material to Thurber of Maine, and behold! A parade going down Main Street with every one of these devices life size on a series of floats. We shall call it "The tragic funeral of Madame Fly," or if we take the positive side, "The triumphant procession of the babies."

Let Miss Stewart of New York have it. She will dramatize it for the county fair and Madame Fly and the Baby will act out the whole stunt. Or she may have a weighing and measuring contest to show how much

filth is carried from the garbage cans and which fly deposits the most germs in a glass of milk.

Then we shall turn it over to Jacobs and he would at once make a motion picture trailer out of it to shock amusement seekers throughout the land.

Then, too, it has wonderful possibilities as a Punch and Judy show, as Miss Williams of the National office could show you.

Over in Philadelphia we shall find Nimble Nathan perched in a strategic position armed with a swatter and at least disturbing Madame Fly in her triumphal march, or even breaking up the procession.

Eaves, the younger, will get together in conference the governors of a half dozen states and will secure from them some live dope for press use and a proclamation earnestly calling upon all civic forces to unite in a war to the death. Or it may be that he will secure a letter from the President of the United States or induce the League of Nations to give the tuberculosis associations a mandate to administer the fly population out of existence.

Wells of New York City will probably send Madame Fly to a miniature electric chair, placed on speaker's stand, with a flash of light as the end comes.

But what would some of the others do with them? Several state secretaries would dream of getting a good cartoonist on the job and making up several more or less comic strips to be supplied in plate or matrix form for newspapers throughout the state. Or else they dream of a series of sketched advertisements showing one stage of Madame Fly's career daily — to be continued to-morrow and financed by the local hardware men.

On the other side of the globe Dr. Peter will make up a whole show and we shall need to get out a revised edition of The Health Show Comes to Town. Dr. Peter will dramatize it on both street and stage. He will show us a gigantic fly emerging from the pile back of the stable; the baby will cry; and with the aid of his ingenious Chinese helpers the fly will fly, until at the end, Dr. Peters draws back a great curtain, when, stretching for into the distance, will be shown row upon row of tiny graves, or else, a great swarm of more than a million descendants of that one monstrous creature.

When IS this exhibit to be?

There are thousands of copies in its present form, but no one has started to work up its varied exhibit possibilities.

Suppose that Oklahoma and Maine, Wisconsin and Philadelphia, and the rest of us, did get busy and then we all used all forms of the exhibit? I dare not prophecy results.

But this will not happen probably until we pool our ideas and our funds and set several folks at the task of doing the job for all of us.

Why don't we do it?

We haven't the time to think out the details of the ideas and the details of the construction — every one has too much else to do.

Then, too, many of us do not get to do enough of this sort of thing to

gain facility in fully developing the big ideas we do get in the midst of the work which must be done to-day because it was not done yesterday.

Wherefore, and finally, When is an exhibit?

When we can reach the kind of people we wish to reach.

When we can take the trouble to make a plan for reaching the kind of people we wish to reach.

When we find that an exhibit is better than something else in making the plan for reaching the kind of people we wish to reach.

When we can produce the kind of exhibit that is better than something else in making the plan for reaching the kind of people we wish to reach.

When we can spend the money necessary to produce the kind of exhibit that is better than something else in making the plan for reaching the kind of people we wish to reach.

When we have a concrete message worth spending the money necessary to produce the kind of exhibit that is better than something else in making the plan for reaching the kind of people we wish to reach.

Then is an exhibit!

HEALTH EDUCATION THROUGH THE SCHOOL

By Willard S. Small, Ph.D.

Washington

It is difficult for a speaker to bring his own mind back to heel immediately after being absorbed in such an interesting picture as the one just shown and it is equally difficult for the auditors. But inasmuch as I am here and you are here and as I should have spoken Wednesday but didn't, I will speak briefly upon the subject that was assigned to me: "Health Education Through the School."

That is a double-barreled subject at least. At times it seems to me three or four-barreled. I sometimes think when subjects of that kind are assigned there ought to be some indication as to which one of the barrels is to be fired.

There are those who think that all health education is a kind of glorified propaganda whereby the public at large is to be made wise in regard to health matters through graphic or dramatic or melodramatic means and that that kind of information constitutes health education.

On the other hand, I find those who think of health education as being identical with a complete program of health promotion, health protection and health instruction on the part of the schools. I do not know in which sense the term is used here but I assume that the term is used in the sense of making the school perform its necessary and logical duty in the promotion of health.

I think you will all realize that in the past twenty years there has been a very extraordinary increase in the recognition and appreciation of the relation that exists between health and education. I still find some, however, who in books and pamphlets talk about health and education as though they were two different if not antithetical things. Recently I read in a very important book on the hygiene of the school child, that health ought to be put before education. I can't quite see the logic of that way of thinking. It seems to me that health is distinctly an essential objective of education. It is one of the things that we ought to insist upon at all times. Health is not a gift of Providence, it is something that in large measure has to be acquired. Of course nature varies its endowments. The potential health of individual children varies as does potential length of legs. The point I want to emphasize is that health is no more a gift of God than the ability to play the piano is a gift of God. The ability to play the piano *is* a gift of God but we have to learn how to use the gift. Some persons come into the world gifted with a neuromuscular organization which enables them to do that kind of thing; others

are born with other gifts which enable them to know and do other things, but we all have to learn. If we are going to be healthy, if we are going to be strong and able to do our work, all of us have to learn and live the simple laws of health.

As I see it, there are five ways in which schools function in educating for health. They are logically distinct but practically interrelated.

In looking at the last picture, the one in which the young man went to the sanatorium and was restored to health, I was struck with the magnificence from the health point of view of the sanatorium. It occurred to me at that time that the school plant ought to be just as wholesome as a sanatorium.

I should say that is a very definite obligation resting upon the schools. They should provide a wholesome school environment. Young plants and young animals do not thrive in cramped and unwholesome environment. No more do children. The first obligation then — one that ought to be and that can be fulfilled — is to provide wholesome environment in which children can live and grow. And that means not only sanitary but ample and pleasant, the kind of a place where children can grow into healthy and vigorous manhood and womanhood.

Then there ought to be hygienic school management. A great many schools are so managed that the atmosphere in the school does not radiate good cheer and does not induce the children to strive for health. The thing that I should like to see in the schools is an atmosphere such that the entire procedure of the schools is suffused with ideas and ideals of health. It can be done. There are undoubtedly difficulties in the way.

First of all the teachers must be properly educated. If I had time, I would like to "go strong," upon the matter of educating teachers so that they may effectively perform their proper health functions in the schools. This means something more and something different from methods of "teaching health." It means reorganizing our normal schools and the other schools in which our leaders in education are trained; putting them on a sound hygienic basis so that the lives of the students in those schools will be formed (or reformed if necessary) along the lines of hygienic habit. I have little faith that teachers are going to teach health effectively unless out of their own experience they have learned the meaning and the joy of health and how it is attained. I have little faith that teachers who are merely taught how to teach health are going to get very far.

We can have and we ought to have a hygienic school management in which essential physical conditions such as lighting, ventilation and sanitary decencies are continuously respected; in which the daily program is so organized as to conserve the energies of pupils and teachers and to avoid undue fatigue and nervous strain; in which the disciplinary atmosphere radiates good cheer, confidence and industry. It is the individual classroom teacher who is directly responsible for hygienic management, but the individual teacher has an uphill job unless she is inspired and sustained by administrative purposes, methods and regulations.

The third thing which I should like to suggest is a proper and effective organization of physical training or physical education. Please do not misunderstand me and think that I mean merely calisthenics or formal gymnastics. They are important but the very essence and basis of physical education is the play activities of the human animal. It is by these activities that the race has achieved its organic efficiency and social efficiency in the past. We need places to play and we need play directed towards developmental ends.

Let us provide, as an integral part of the school curriculum, a program of physical education of this vitalizing kind.

The fourth point is what we might call health supervision. The object of health supervision is to control growth conditions. It must be recognized that the conditions that determine or influence normal growth are numerous — not less than fifteen distinct types. Not all of these are controllable through the school, but most of them can be more or less controlled by the school, working with the home and other appropriate social agencies. Through expert health supervision of schools and school children, it may be known whether the conditions that make for normal growth are fulfilled.

Finally, there is the idea of teaching health or training for health. I want to call your attention to the fact that we always should have in mind, for the younger children especially, the idea of training them into the practice of habits which will guarantee health, so far as any habits guarantee health. We depend too much upon giving information. We cherish the fallacy that, if children are told and are able to repeat some formula in regard to health, we are educating them into health; but of course we know perfectly well that even if a child can repeat the whole decalogue of health habits it is no proof that he is going to practice any one of them, any more than the ability of a Sunday School boy to repeat the ten commandments verbatim proves that he will habitually observe them.

We have got to tackle the problem with the aim of stimulating vital interest on the part of the children in doing those things that make for health. The mere giving of information about health is a very small part of that.

I think that the Modern Health Crusade, with its programs of chores, is on the right track. I have told my good friend, Mr. DeForest, a number of times that perhaps there is too much machinery in the Modern Health Crusade; but the important point is that the Modern Health Crusade is driving at the practice essential to health.

But we shall have to be rough and ready about it. I heard the other day from some friends in the Child Health Organization the story of a teacher in this city who has discovered a way not only of interesting children in health but also of making them at least form good resolutions in regard to health through the use of the sporting page of a yellow newspaper as a text book. I am hoping sometime to see the results of the use of that text book published.

Last winter, while assisting in a school survey in Wheeling, I found a

number of interesting things in the way of health teaching. One of these proves that the teachers themselves are sometimes called upon to make sacrifices in order to make their teaching effective. One teacher had a "No Coffee Club" in the third grade. She got all of her pupils but one to join this club and live up to the regulations of the club. This one fellow was quite as recalcitrant as the girl in the picture shown a few minutes ago. The teacher asked him many times to give up his coffee and he finally said, "Teacher, when you give up yours." She ruefully admitted that she hadn't given up hers, so she had to do it.

It is important to enlist the active interest of children. Children are a great deal like the small animals. Perhaps you remember Kipling's story of Riki Tiki Tavi. He was the little mongoose the motto of whose family was "run and find out." Normal children are much like the mongoose. They like to "run and find out." We should recognize this fact in our health teaching and guide the running. We could save ourselves a great deal of trouble in the way of giving them pre-digested information which they could have found out for themselves and will find out for themselves.

TUBERCULOSIS, MARRIAGE AND MATERNITY

By Maurice Fishberg, M.D.

New York

Rational eugenic teachings of recent years have had their effects on the large and growing portion of our population which exercises prudential foresight before entering matrimony, and avoids reckless procreation when there is any doubt as to the probable physical and mental qualities of the newborn. Owing to its wide prevalence, its chronic course extending over many years in a large proportion of cases, and its tendencies to remissions during which the patients feel comparatively well, tuberculosis very often creates problems of marriage and maternity. The unmarried ask whether they may marry; the married inquire whether they may have children with safety to themselves and to future generations.

A large number of physicians have answered these queries in the negative in practically all cases. Not only patients with active disease have thus been enjoined but also those who have had tuberculosis, but have more or less completely recovered, and some physicians have even gone so far as to prohibit, or at least to discourage, matrimony and parenthood of those whom they considered "predisposed" to the disease.

The grounds for these prohibitions are not far to seek. Primarily, it has been argued, marriage endangers the healthy consort who is likely to contract the disease by intimate contact with the tuberculous spouse. Marriage is also said to be dangerous to patients, especially of the female sex. Moreover, on eugenic grounds, it has been alleged that inasmuch as tuberculosis, or a tendency to this disease, is transmitted by heredity, parenthood on the part of persons suffering from this disease is sure to increase the number of tuberculous individuals in generations to come.

DANGERS TO THE HEALTHY CONSORT

It is a striking fact that admissions to sanatoria of both husband and wife, either simultaneously or consecutively, are exceedingly rare. Similarly, in the tuberculosis clinics in our large cities, in which an enormous number of married tuberculous patients are treated, it is very rare to find that both husband and wife are under treatment for active tuberculosis. This fact becomes more significant when we bear in mind that it is different with other transmissible diseases, like typhus, influenza, smallpox, syphilis, gonorrhea, etc.

Five years ago I made an investigation of this problem among 170 married couples in which one of the consorts was tuberculous. They lived

under conditions favoring the transmission of the disease, most of them sharing the same room and bed. Still it was a remarkable fact that only in 5, or 2.0 per cent. of the cases, were both the husband and wife affected with "open" tuberculous disease. Considering its prevalence among the general population, we should expect that between 6 and 7 per cent. of husbands of tuberculous wives, or wives of tuberculous husbands, would be affected with the same disease. As it is, we find that the chance of "contracting" tuberculosis from a sick consort is about the same as contracting diabetes, cancer, or insanity.

There is another way of testing this problem. A very large number of well known and great men and women were tuberculous. I have looked up many of those who were married and in not a single case have I discovered that their consorts were also affected by the disease. Moreover, many of the physicians working in sanatoria all over the world have taken up this work because of the condition of their own lungs. Among those who are married it is exceedingly rare to find that their wives have contracted the disease.

These facts prove conclusively that the dangers to the unaffected consort are negligible, and should have no influence when a contemplated marriage between a tuberculous person and a healthy person is considered.

DANGERS TO THE TUBERCULOUS CONSORT

When discussing the effects of married life on a tuberculous individual we must differentiate between the various types of the disease which pass under the term pulmonary tuberculosis. On the one hand we have the acute fulminating cases, commonly known as hasty consumption, as well as the final acute stage of the disease which ushers out many of those who have suffered from any of the chronic forms for months or years. Patients with these forms of the disease are acutely sick, just as those who have pneumonia, typhoid, acute articular rheumatism, etc. The problem hardly ever arises in this class of cases, excepting in rare instances when, as a result of the euphoria characteristic of some tuberculous cases, they delude themselves into thinking that they must be united in matrimony, but as a rule, the consorts-to-be refuse to enter into the bargain. In the rare instances in which for either sentimental or emotional, or because of some valid material reasons, marriage is demanded, it may be permitted because obviously no harm can result to either of the contracting parties, or eugenically.

The problem of marriage confronts us mainly with patients who suffer from the chronic forms of tuberculosis. Among them we have those with active disease, requiring prolonged treatment; those in whom the disease is quiescent, and they are fairly well able to attend to some occupation, barring the incidental exacerbations of the process which disables them now and then for some time; and those in whom the disease has been arrested, and the only problem that arises is whether they are likely to suffer from a relapse. It has been maintained that married life often

proves disastrous to all these, especially women. Indeed, it appears that persons with the stigma of tuberculosis often find it difficult to marry because of the alleged dangers to themselves, as well as to the progeny.

It is clear that those with arrested lesions should not be restrained in this regard. Whether a relapse will occur hardly depends on the matrimonial state. Moreover, celibacy by no means implies abstinence, and extramarital relationship usually involves excesses and additional risks. Inasmuch as there is no danger to the healthy consort, as we have seen above, it is decidedly unjust and in many cases anti-social to prohibit marriage to these patients.

With active chronic tuberculous disease things are different. Here considerable caution is to be exercised, especially in the case of women. Experience with many of this class has taught the writer that here again we must discriminate between those in whom the lesion is of the kind which we call "early," and those in whom it has been running a sluggishly chronic course for months or years. In the former, a prognosis cannot be formulated with safety. They may recover within a few months, or the disease may run a progressive course; in the latter case the prognosis can be made with a reasonable degree of certainty. Inasmuch as in addition to the problems of clinical pathology there are, in the majority of cases, also involved material problems, our decision in this sort of cases must be guarded.

In early cases marriage should be postponed until an idea is gained as to the course pursued by the disease. If arrest is attained — and with proper treatment it is in a large proportion of cases — there is no reason for prohibiting marriage. If the course is progressive, the patient will not think of marriage, excepting in the rare instances mentioned above.

It is different with the exceedingly chronic cases which constitute the majority of patients who consult us in this regard. They have been sick for years, have had remissions in the disease which made them think that they had completely recovered, but sooner or later they have been disabused by exacerbations which proved conclusively that the lesion is still smouldering. The signs elicited by physical exploration of the chest also show clearly that they have active lesions; in many, cavities are found. But having adapted their organism to the toxic state, they feel more or less happy, though always apprehensive of an exacerbation of the disease.

I can see no reason why many of these patients should be prohibited from marrying, provided they find suitable partners who realize the tasks they undertake and are willing to face them. Our patient, who may have been despondent from lonesomeness which tuberculosis often bestows, may thus find a companion and Samaritan. The dependent young woman, unfit for continuous work for her support, but unwilling to spend the rest of her days in an institution, may thus find a man who takes good care of her, affords her frequent vacations, and thus keeps her in good condition for years despite the fact that physical signs show that she has a tuberculous lesion in her lungs. A tuberculous man, who has been shunned by members of his family and friends because of the exaggerated notions of

infection which have been instilled into the general public during recent years, or who may not have been able to obtain lodgings in the city, may thus find a woman who is brave and willing to extend him a helping hand at a time when others treat him as an outcast.

We have seen that there is no danger of infection of the healthy consort. There has never been adduced uncontrovertible proof that marriage will harm the tuberculous consort. It is open to serious question whether unmarried tuberculous individuals live longer than those who are married. The scanty statistics on this subject that are available tend to show that the reverse is true. Moreover, as has already been maintained, we must never lose sight of the fact that celibacy by no means implies continence, and extramarital relationship involves excesses and additional risks to the tuberculous.

Another class of patients who often inquire as to their fitness for marriage are those whom some physicians have grouped under the term "predisposed." It may not be generally known, but it is a fact that we do not know who is predisposed to tuberculosis and who is not. I have practiced medicine for twenty-five years, and have cared for many thousands of patients, yet I can candidly state that I cannot say, after carefully examining a person and subjecting him or her to the most approved clinical tests, whether he will at any time develop tuberculous disease, or not.

We are at present beginning to realize that the signs which were considered as predisposing, such as the flat and narrow chest, scars indicating ancient glandular disease, feeble musculature, etc., are indications of actual but smouldering tuberculous disease, as a rule. Moreover, experience has taught that when developing active disease of the lungs these persons are usually in less danger of being carried off by a fulminating or hasty process than those who are physically unblemished. It is the muscular, athletic and the vigorous who go fast when developing tuberculosis.

MATERNITY

Because many women date back the onset of their lung disease to pregnancy, labor and lactation, many physicians have prohibited maternity to all who have active tuberculous disease, as well as to those who had been cured of an attack several years back, and many have warned those whom they considered predisposed. Because of the alleged hereditary transmission of the disease, or of a tendency to it, the teaching has been that, even when maternity is eagerly sought, the chances in favor of raising a healthy child at the risk of the mother's life are very slight.

Careful observation among numerous pregnant tuberculous women has, however, shown that not in every case is the disease aggravated by maternity, and that not every child born to a tuberculous woman is doomed. Many women under my care disregarded my warnings, and passed through pregnancies, labor and lactation without any apparent harm to themselves, and raised healthy children. In some cases the lesions in the

lungs were arrested or healed, but in others far advanced, cavitary lesions were found, yet they passed through these physiological processes unscathed. Moreover, it appeared that the ancient observation that some tuberculous women are distinctly benefited by marriage and maternity is sustained very frequently. There is no doubt that many chlorotic girls, showing indefinite symptoms and signs of incipient tuberculous lesions, are often cured by marriage and pregnancy. The internal secretory activity of the female generative organs has an immense influence on the symptomatology and course of tuberculosis of the lungs. Observant clinicians have noted this relation in cases of tuberculosis in adolescent girls and in women during the menopause.

But we meet in books and monographs on tuberculosis statistics showing that while during pregnancy the lung lesion may be in abeyance, soon after labor the disease flares up and kills the patient sooner or later. These statistics have mostly been gathered by obstetricians, and concern patients with active and progressive disease. Some state that over 90 per cent. of tuberculous women are doomed by pregnancy and maternity; others put the percentage down as 75, still others, 60, 40, 20, and even as low as 10. The wide divergence of these proportions, running from 90 to 10 per cent., shows that they are either inaccurate, or based on clinical material which is not comparable.

Statistics published by internists, who have classified their clinical material, show that when the active and progressive cases are eliminated, and only the chronic cases are considered, irrespective of the so-called stages of the disease, pregnancy and maternity have little, hardly any, deleterious influence on the course of tuberculosis. Of fourteen tuberculous women under my care who had become pregnant during the past two years, twelve are now alive, and to my mind find themselves in the condition in which they would be expected to be had they not become pregnant. Likewise, Norris and Landis found that among the patients at the Phipps Institute 85 per cent. showed no change in their condition as a result of pregnancy, though 70 per cent. of the women were in the advanced stages of tuberculous disease. But when we deal with a large number of tuberculous patients, men or women, pregnant and sterile, about 20 per cent. will show aggravation of the disease during the course of two years which pregnancy and lactation involve.

Similar statistics have recently been published in Europe. Forssner calculated that 881 patients observed during the period 1907-1912 were not better off than 133 who became pregnant. Schäfer, in a study of the after-histories of married women discharged from a sanatorium, arrived at about the same conclusion. Of 425 patients thus observed during a period of 3 to 18 years, 136 had not become pregnant, and 189 had undergone from 1 to 7 pregnancies each since discharge. In 76.2 per cent. the women were still fit for ordinary or light work despite the fact that they had been pregnant and gave birth to and raised children. He found that only 18.4 per cent. had died of tuberculosis, but in only 13.7 per cent. was death due to progress of the disease in connection with pregnancy.

From these figures, and many others that could be cited, it appears that if we exclude acute and progressive cases of tuberculosis who should not marry or procreate because of the acute disease, the dangers of pregnancy for tuberculous women have been exaggerated. Even when repeatedly occurring, pregnancy and maternity is well borne by the vast majority of women suffering from the chronic forms of pulmonary tuberculosis. To be sure, from 20 to 25 per cent. may suffer from an aggravation of the lung disease during the period of pregnancy and lactation. But this may be considered coincidental in most instances. A similar proportion of tuberculous patients suffer from exacerbations of the disease during a period of two years involving pregnancy and lactation.

LABOR IN TUBERULCOUS WOMEN

Obstetricians agree that labor is no more likely to be difficult and protracted than in non-tuberculous women. It is indeed often amazing to witness an emaciated woman give birth to an infant in record time. The loss of blood during this process may be considered negligible. It has been estimated that the amount of blood lost during normal labor is between 300 and 500 grams, and experience has shown that it is soon regenerated by extra labor of the hematopoietic organs. More blood is often lost during pulmonary hemorrhages and the patient soon regains it; after labor the blood-forming organs are even better prepared for the task.

THE NEWBORN INFANT

Congenital tuberculosis is extremely rare, and may be left out of consideration when speaking of inheritance of this disease. In fact, experience has shown that physically the newborn infants are, on the average, about the same size and weight as those born to non-tuberculous mothers. Stillbirths also are no more frequent than among non-tuberculous women.

It appears that infection with tubercle is the more dangerous the younger the infant. Thus, when infected during the first month of life, the infant is in great danger, though not invariably doomed, as some writers have maintained. I have seen many infants raised by mothers with open tuberculous lesions. But on the whole, the mortality among these infants is extremely high owing to infection with tubercle, bottle feeding, etc. However, if removed from the mother immediately after birth and fed by a wet nurse, or with properly prepared milk, most of these infants may be, and are, raised to healthy maturity. As was already stated, many are raised by their mothers. This is seen in any clinic caring for tuberculous patients. Numerous women, with open tuberculous lesions, bring their children who are in excellent condition. With greater care than that which the poor can afford, with immediate isolation from the mother, the chances of survival of the infants born to tuberculous mothers appear to be not much less than of those who were borne by healthy mothers.

CONCLUSIONS

The indiscriminate prohibition of marriage and maternity to tuberculous patients is unjust. The vast majority bear these physiological processes without any ill effects. The danger of transmitting the disease to the healthy consort is insignificant. Tuberculosis in husband and wife, simultaneously or consecutively, is exceedingly rare.

Those with the chronic forms of tuberculosis may marry; tuberculous women with these forms of the disease, as well as those in whom the disease is quiescent or has been arrested, bear maternity with impunity. Some are even benefited. Statistical figures, carefully collected, show that in about 20 per cent. of cases an aggravation of the tuberculous disease occurs soon after pregnancy, but about the same percentage of tuberculous patients who do not become pregnant show exacerbations of the disease during two years which pregnancy and lactation involve. Labor is no different in tuberculous women than in the average non-tuberculous. The newborn infants are, on the average, of the same physical development as others. If removed from their mothers, their chances of survival are about the same as others of the same social class.

Marriage should be discouraged in patients with acute and progressive disease, just as it is in persons suffering from other acute diseases. In early cases marriage should be postponed until an idea is gained as to the course the disease tends to take.

DISCUSSION ON PAPER BY DR. FISHBERG

Dr. George Mannheimer, New York: Sir William Osler, one of the founders of our Association, says in his textbook, which is a standard in all the medical schools of this country, as follows:

> The question of marriage of a person who has arrested or cured lung tuberculosis is difficult to decide. In a male the personal risk is not so great; and when the health and strength are good, the external environment favorable, the family history not extremely bad, the experiment — for it is such — is often successful. In women the question is complicated with that of childbearing, which increases the risks enormously. With a localized lesion, absence of hereditary taint, good physique and favorable environment, marriage might be permitted. When tuberculosis has existed, however, in a girl, whose family history is bad, whose chest expansion is slight and whose physique below the standard, the physician should place his veto on marriage. With existing disease, fever, bacilli, etc., etc., marriage should be prohibited. Pregnancy usually hastens the process though it may be held in abeyance. After parturition the disease advances rapidly. A married woman may bear the first confinement well, the second with difficulty, the third never. Conception may occur in an advanced stage of the disease.

The large majority of authors agree that pregnancy is a dangerous complication of pulmonary tuberculosis. They are unanimous in their belief that active disease is unfavorably influenced by pregnancy, furthermore, that even in non-active tuberculosis the possibility exists of the disease becoming activated. Even if a first pregnancy has terminated normally, even if an exacerbation fails to appear in the early months of

a second pregnancy and the general condition remains good, there is no guarantee, in a manifest case of tuberculosis, that a sudden turn for the worse will not take place. Who can tell when a process is cured, arrested, quiescent, to such a degree that the woman can stand the vicissitudes of childbearing, labor and lactation? As long as this uncertainty exists, it is well to err on the side of caution.

Animal experiments are in support of caution. In artificially infected guinea pigs, the tuberculous nodules grow more rapidly, caseation occurs at an earlier date and at a quicker rate and death ensues much sooner, if the animals become pregnant. Some immunologists believe that the formation of anti-bodies is diminished in the pregnant state. Think of what some healthy women suffer with nausea, loss of appetite and vomiting in the early months of pregnancy, how they are reduced in their nutrition. Think of the strain of repeated vomiting. Is not a tuberculous woman doubly endangered by these complications? Think of the tremendous strain of labor. Cannot that strain break down resistance by literally breaking the fibrous envelope of one or many tubercles? Tuberculosis of the larynx, whether active or quiescent, is almost invariably made worse by pregnancy and labor. Cases are on record where, after a spontaneous abortion miliary tuberculosis developed with fatal outcome. At autopsy tuberculous foci were found in the uterus — and there is such a thing as tuberculosis of the uterus or adnexa which is quiescent or simply gives rise to painful menstruation. The tuberculous foci in these cases not only caused the abortion, but they also, through the opening up of many blood channels, furnished the source for the flooding of the entire system with tubercle bacilli. A tuberculous woman may go through pregnancy and feel well, but breaks down during the lying-in period. Galloping consumption is not at all rare at that time. Nursing, especially when prolonged, is likely to be detrimental to a tuberculous mother. The child is in imminent danger of becoming infected if one tuberculous parent discharges bacilli. Under these circumstances, the child must be removed to healthful surroundings. What a sacrifice for the parents. All in all, a woman with tuberculosis, be it ever so benign, runs a greater risk in marriage than a man. Pregnancy, labor, the lying-in period and lactation constitute a decided complicating factor of pulmonary tuberculosis and in too many instances an unfavorable one.

My remarks are intended to emphasize the safe side of the issue.

I wonder whether the reader of the paper meant to be as iconoclastic as he sounded to some of you. Perhaps he wanted to upset some of those aphorisms that run about like this: A tuberculous woman should not fall in love; if she does, she should not marry; if she marries, she should not conceive; if she conceives, she should not carry through.

I wonder whether he did not simply mean: Do not follow the old inherited routine of prohibiting marriage in every case. Individualization is the keynote in this as well as in other medico-social problems.

Tuberculosis, marriage and maternity may go well together in a comparatively small number of selected cases. So far, I believe most of us

will agree with him. But when he says: Those with the chronic forms of tuberculosis may marry; tuberculous women with these forms of the disease, as well as those in whom the disease is quiescent or has been arrested, bear maternity with impunity — when he says that, we protest and take issue. We have on our side the majority of medical men, clinicians and obstetricians, who have become gray in the practice and teaching of medicine, whose conclusions are based on ripe experience.

In any case, where the question of tuberculosis, marriage and maternity comes before us, we should lay that ripe experience before the persons involved with a strong recommendation of caution in case of doubt. Unfortunately, they frequently follow the dictates of their hearts rather than of their brains, and then later on, the physician only too often has the sobering experience of telling the widower: "I told you so."

Dr. B. S. Pollak, Jersey City: Dr. Fishberg's paper reminds me of the fact that one must stick to a friend at all times. I believe thoroughly in Dr. Fishberg's views. Dr. Fishberg has brought out some wonderful points and if they or their main features were accepted generally, people would have a very comprehensive understanding of the problem. In other words, if we thoroughly understood the relation of tuberculosis to childhood, in a great many instances we would not be afraid of tuberculosis nor of advocating marriage under certain conditions, as specified in Dr. Fishberg's paper. Then there would not be the present objections to other problems that we are meeting.

For instance, it is generally recognized that hospitals in general will not admit tuberculosis patients and until they do admit them, neither the students nor the nurses will be able to learn the tuberculosis problem. That of course is based upon the fear of tuberculosis infection. It was not long ago that I was in a certain hospital where a superintendent of nurses gave instructions that the linen of the tuberculosis ward was not to be passed by the operating room because the nurse in question was afraid that the patient under operation might perhaps be infected by the tubercle bacilli.

Edward Hochhauser, New York: When I heard that Dr. Fishberg was to address us on Tuberculosis, Marriage and Maternity, knowing him well and how he likes to stir us up and keep us from getting into a rut, I was afraid he might make general statements which might be misinterpreted.

One member of the conference, who could not be present to-day agreed with the view which she expected Dr. Fishberg would present. It was her experience that all tuberculous women are better off if they have children. We remember that Dr. Fishberg told us that only in certain cases, where the doctor believed pregnancy was wise, he would advise her. In other words the doctor after careful observation is to decide whether childbirth is safe or dangerous. However, there are other implications in this question of advising childbirth for tuberculous women — social implications.

When there is a large family and an inadequate income — what are we

to advise? We should consider this as much as the effect upon health of the patient or upon the child even if we remove the child immediately after birth.

Dr. Fishberg: I think I was misunderstood. I hardly advocated the marrying of tuberculous people. I am no agitator and didn't mean anything of the kind, and never shall agitate for or against it. I said under certain conditions I advise it. When a woman comes around to inquire what she should do, in answering her, we are not always taking into consideration the fact that she may have five children, or live only in three or four rooms, while advising her whether she should limit the number of children in the future, according to the present practice of medicine.

I personally have indulged in this advice very frequently in talking to tuberculous women with too small an income. When a tuberculous patient inquires whether she or he may marry I advise along definite lines, not necessarily sociological. I am sorry we haven't more time for discussion.

THE EVIDENCE OF INTENSIVE ANTI-TUBERCULOSIS EFFORT UPON THE DEATH RATE

By Lee K. Frankel, Ph.D.

New York

When Mr. Eaves asked me to prepare a paper on the above subject for the meeting of the Sociological Section, I took occasion to re-read a paper which I read before the Mississippi Valley Conference on Tuberculosis in Indianapolis, Indiana, in September, 1915, and found the statement which follows:

"The statistics for tuberculosis (Metropolitan Life Insurance Company) are very interesting. They show that within the short period of three years, the death rate interesting. hey show that within the short period of three years, the death rate from tuberculosis in the company's experience dropped from 208.7 per hundred thousand to 189.6 per hundred thousand, or a reduction in the rate of 9.1 per cent. These figures supplement those for the Registration Area for the years 1901 to 1911, which show a rate in 1911, 83 per cent. of that in 1901. All of this indicates that the campaign of education which has been carried on for over a decade, is bearing and has borne fruit. It is fairly safe to predict that the experience of the next three years will show a further reduction in the tuberculosis death rate of the country and of the Life Insurance Companies."

Nearly six years have passed since the above was written, and the query which will naturally arise in your mind is "Has this prediction been fulfilled?" I doubt whether even the most sanguine and enthusiastic friends of the anti-tuberculosis movement could have ventured to hope that the tuberculosis death rate would fall more rapidly in the six years referred to than in the preceding three years. When one recalls that within the six-year period, we have had two extraordinary epidemics of influenza, it might have been anticipated that at least in the latter part of the period the death rate from tuberculosis would have risen. As a matter of fact, the opposite is the case.

The following table is submitted:

Death rate per 100,000 from Tuberculosis of the Lungs.

United States Expanding Area.* — 1900 to 1919.

Year	Death rate	Year	Death rate
1900	181.8	1910	139.7
1901	176.2	1911	138.2
1902	164.3	1912	130.0
1903	166.5	1913	127.9
1904	177.9	1914	128.2
1905	168.5	1915	128.2
1906	157.1	1916	124.3
1907	155.9	1917	129.3
1908	145.5	1918	132.2
1909	139.3	1919	111.3

You will see that the death rate for pulmonary tuberculosis had dropped from 181.8 per 100,000 in 1900 to 111.3 in 1919. This is a decline of 39 per cent. and means that sixty thousand fewer deaths occurred in the United States Registration Area from pulmonary tuberculosis in 1919 than if the 1900 death rate had prevailed. I have also had prepared trend lines for the first decade, 1900 to 1909, and for the second decade, 1910 to 1919. The graph on page 508 illustrates the crude and trended figures for both the expanding Registration Area, and for the Industrial Department of the Metropolitan Life Insurance Company, 1911 to 1920. You will observe that the tendency toward decline in the Registration Area is not so great in the second decennium as in the first. But, it is, nevertheless, very appreciable. Certainly, there is no ground, on the basis of these figures, to complain that the rate of reduction in the tuberculosis death rate is too slow. It is a very encouraging picture, and especially so are the facts for the last few years. I call your attention especially to the very low rate for 1919, namely, 111.3, which, it is probable, has been reduced for 1920, although the official figure is not as yet available. I stress this point because those who have found fault with the anti-tuberculosis campaign have emphasized the fact that the reduction in the death rate was coming to a standstill, and that the rate would soon actually rise to higher levels. The figures for very recent years have entirely belied their pessimism. The tuberculosis death rate in the United States is still very much on the decline, and the conditions of the last few years are encouraging indeed.

If the only question at issue were the decline in the tuberculosis death rate, I think you will agree that the statistics given would be ample to prove this. The problem propounded in the title of this paper still remains unanswered. Has this reduction in the death rate been caused

*Note: Tuberculosis of the lungs and tuberculosis of the larynx combined for 1900-1909 series. Tuberculosis of the lungs and acute miliary tuberculosis combined for 1910-1919 series. Combinations make two series comparable and continuous with respect to inclusions under titles.

by the anti-tuberculosis campaign? Have the fundamental principles of the anti-tuberculosis campaign been the predominating factors in producing this reduction in the death rate? Can we say that sanatorium treatment of early cases, segregation and treatment of advanced cases, development of proper and adequate housing, living and working conditions, instruction in the value of rest and fresh air as curative and preventive agencies, education of the masses in personal hygiene, and the various other principles which are phases of the anti-tuberculosis campaign, have been instrumentalities which have brought about the desired results?

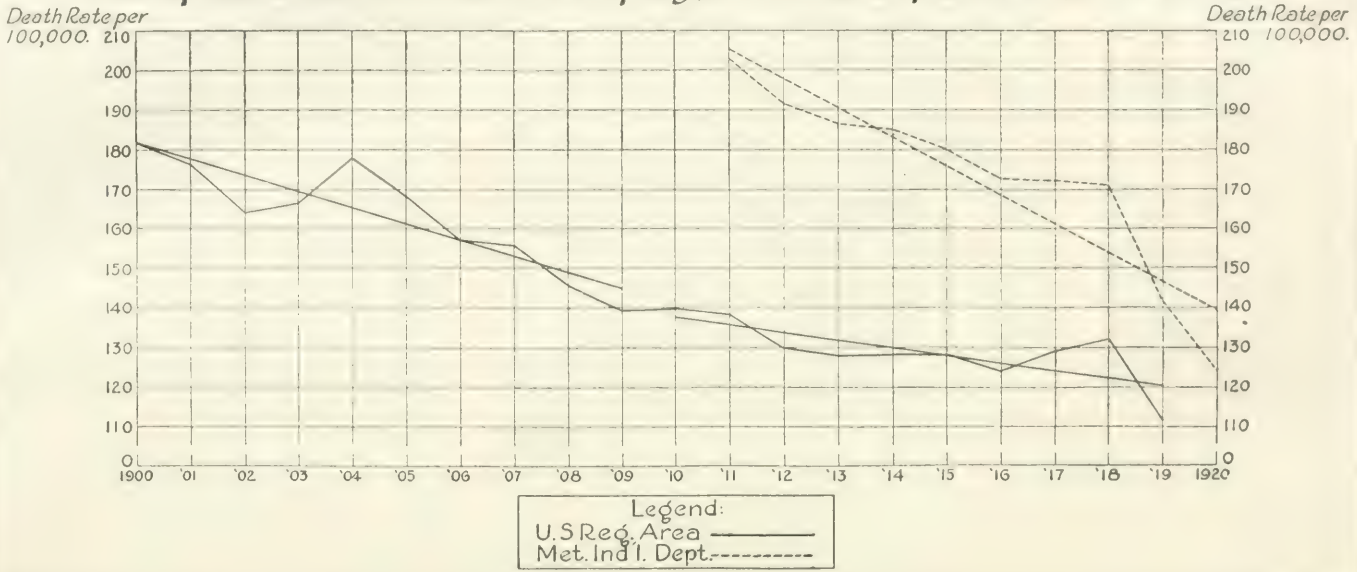
Let us admit, frankly at the outset, that the anti-tuberculosis campaign alone has not brought about these reductions in tuberculosis mortality, nor can we claim that it has favorably influenced tuberculosis morbidity. With respect to morbidity, we have practically no data to prove whether there are fewer cases of tuberculosis today than there were a decade ago. If the results obtained in Framingham are any criterion, it would appear that there are still many undiscovered cases of tuberculosis in most communities unknown to the authorities, even where there is compulsory registration, and in many instances unknown to the sufferers themselves. It is quite likely that further studies will require us to revise our estimate of the number of living cases to each death.

Furthermore, there can be no doubt that the intensive campaign which has been carried on for the general improvement of the public health has had its marked influence on tuberculosis. The reduction in death rate has taken place not only with respect to tuberculosis, but with other diseases as well. In fact, for certain diseases the reduction has been even more marked than for tuberculosis. The close relationship between tuberculosis and certain other diseases is quite marked. Observations have been made showing that where there is a reduction in mortality from these diseases, a reduction in the mortality from tuberculosis follows.

Viewing the subject without bias, I think you will agree that since the year 1914 an unpremeditated demonstration or experiment has been carried on in the United States, which has had a marked effect upon the tuberculosis death rate and which has given at least a partial answer to our query. This demonstration has been nation-wide in character. It has affected practically all elements of the population. It depended primarily upon the fact that as a result of the war, and immediately following the beginning of the war, the scale of wages rose in practically every industry. The result was unconscious but inevitable. Millions of workingmen and their families were able to live better than had been possible before. They were able to purchase more food and better food. They were able to have better housing accomodations, and were able to obtain rest and recreation. These conditions, which have always been fundamental principles of the anti-tuberculosis campaign, have undoubtedly materially affected the tuberculosis death rate.

If this statement may be questioned, let me point to the other side

Death Rates per 100,000
TUBERCULOSIS OF THE LUNGS
United States Registration Area, 1900 to 1919
and
Metropolitan Life Insurance Company, Industrial Department, 1911 to 1920.



of the picture. During this same period of time, another unpremeditated demonstration was being conducted on the Continent of Europe. There it was found practically impossible to continue the anti-tuberculosis campaign. An adequate food supply was unobtainable. Owing to the destruction of homes and the lack of building, housing conditions became acute, and congestion resulted. And then, there was the strain and worry occasioned by the war itself. All these conditions are too well known to you to require repetition here. The effects of this maladjustment, of these evil conditions of life and health, were as equally pronounced as the result in the United States, but were a direct antithesis of these. Beginning with the first year of the war and increasing thereafter, each year showed an even higher death rate, not only in the military, but especially in the civilian population. It was the experience of all relief workers on the other side that the first few years of the war undid all the favorable effects of the previous thirty years of public health work. The conditions with respect to tuberculosis in most European countries are too well known to you to require an elaboration of this statement by statistics. Generally speaking, the returns for the more recent years, including 1919, show death rates from pulmonary tuberculosis double and treble those prior to 1914.

Tuberculosis is the outstanding health problem of Europe today, not because there has been any fundamental change in the race stocks; not because the strong have died and the weaklings have survived, but because individuals have been for five years face to face with bitter hardships unprecedented in modern history. Lack of food, of housing, of clothing, increased worry, the disregard of hygiene, and the general misery together are responsible for the results.

I can see no escape from these conclusions. There are some facts in nature which cannot be read wrong. When phenomena are exhibited on a large scale, there can be no mistake as to the relationship of cause and effect. In times of cataclysmic change, the operations of gigantic forces come into sharp relief and clarify the picture which, on ordinary occasions, is very dim. That is the meaning of the change in the tuberculosis death rate in European countries during the last few years.

What is of interest to us is the fact that this unconscious and unpremeditated experiment on such a massive scale, the results of which cannot possibly be misunderstood or misread, have in the last analysis proved the principles for which the anti-tuberculosis movement has stood for so many years. Nothing has been more positive in the anti-tuberculosis campaign than the insistence on decent living in all that this term implies. As members of the Sociological Section in particular, it has been our effort for decades to make officials and others realize that tuberculosis and poverty were brothers. We have insisted upon adequate standards of wages and living; we have insisted upon decent and adequate housing; we have demanded opportunity for play, rest and recreation. It should be a source of satisfaction to all of us to know that the war has proven the soundness of our contention. There can no longer be any

doubt that the fundamentals of public health and of the prevention of tuberculosis and other diseases are adequate food and adequate living and working conditions.

In addition to this massive, tremendous demonstration to which I have referred, reference may be made to one or two smaller demonstrations which have not been unpremeditated but deliberate, and which for a limited group elucidate the value of anti-tuberculosis efforts. I have in mind, first, the Industrial policyholders of the Metropolitan Life Insurance Company, who number at this time close to fifteen million men, women and children, and who comprise a large part of the industrial population of the United States and of Canada. During the last twelve years, they have received a more special service than the general population, not only through visiting nurses, but also from the extensive distribution of health literature directed especially against tuberculous disease. Fortunately, for this group, we have very complete data. I present a second table showing the death rate from 1911 onward, including 1920. The graphic picture of these figures, and the trend line, are shown in Chart 1 (page 508).

Death Rates per 100,000 from Tuberculosis of the Lungs.

Metropolitan Life Insurance Company (Industrial Department)

1911 to 1920

Year	M. L. I. Co., Industrial Dept.
1920	124.0
1919	141.6
1918	171.1
1917	172.3
1916	172.8
1915	180.0
1914	185.2
1913	186.6
1912	191.5
1911	203.0
Uniform annual decrement 1911-1919	5.80
Percentage decline in death rate 1919-1911	30.2
1920-1911	38.9
Ratio, uniform annual decrements	U. S. Reg. Area 5.80 / M. L. I. Co. Ind'l 1.70 = 3.41

In these ten years, the death rate from pulmonary tuberculosis has declined nearly 40 per cent. You will see that the trend line, which has been fitted to show the tendency of the decennium, is much steeper

for this group of insured wage earners than that for the Registration Area of the United States. Comparing the "trend" of the death rate among insured wage earners with the "trend" for the general population, we may say that the "uniform annual decrement" between 1911 and 1919 for the insured group was 5.8 per 100,000 per year and only 1.7 points annually for the general population.

The experience with pulmonary tuberculosis among these insured wage earners so far in 1921 has been very remarkable indeed. The low rates of 1920 are being materially bettered. For the first four months of 1921, the pulmonary tuberculosis rate was 120.0 per 100,000, 19 per cent. lower than the figure 148.9 in the corresponding four months of 1920. The months of the lowest mortality from tuberculosis are still to come. This is an advance indication of how low the tuberculosis figures for this year are likely to be. Please remember that the Industrial policyholders of the Metropolitan are the working people of the United States and Canada. They live largely in cities; they include a large number of the foreign born; many are employed in hazardous and arduous trades. At the beginning of the last decade, their tuberculosis death rate was almost twice as high as for the Registration Area. According to our present indications, their death rate will be as good as that of the Registration Area within six years, that is, 1927. This is a revolutionary change. The evidence is cumulative and more than suggestive that we are reaping the benefit of the work that has been done.

I shall now attempt to show in greater detail that at every point where service is rendered, results are obtained, and that the intensity of the service is reflected in the amount of the reduction of the death rate which is obtained after the lapse of a period of years. The more anti-tuberculosis work we do, the greater the decline in the tuberculosis death rate.

The first point to be stressed is that of color or race. There are millions of colored policyholders in the company, and the figures we have for them make it possible to compare the results of the work done in the two race or color groups of the insured population. The instrumentalities of the anti-tuberculosis campaign are as yet not as available to the colored race as for the white race. For example, there are still communities and states in which practically no provision is made for sanatorium treatment of Negroes. For this and for other reasons, our educational campaign has not had the same effect on Negroes as on whites. Nor did we expect that the amount of reduction in the death rate from tuberculosis among the colored would be as great as among the whites. This is exactly what the figures show. The reduction in pulmonary tuberculosis among white lives in 1919-1920, as compared with 1911-1912, was 33.9 per cent.; among colored lives, it was only 25.0 per cent. It is important not to overlook the fact in this comparison, that the colored race has very materially improved its condition. A reduction of 25 per cent. in eight years is a very remarkable achievement.

Similarly, we have found a differential in percentages of decline in

the mortality rates of the two sexes. Tuberculosis affects males more than it does females. Our educational work has been directed for the instruction of both men and women. It is probable that men profit more by it than women do. Facilities in institutions are taken advantage of more often by men than by women. They are more often able to take the "cure" because of their freedom from family ties. The results indicate a more material reduction of the death rate for males than for females in both races, white and colored. The pulmonary tuberculosis rate for males declined 39.8 per cent. between 1919-1920 and 1911-1912; whereas the female death rate from pulmonary tuberculosis declined only 24.8 per cent. in the same period.

Our third differential is age. Nothing is more striking than the difference in the incidence of mortality from tuberculosis by age. As is well known, the tuberculosis death rate in the first year of life is extremely high and the rate declines to a minimum in the age period five to nine years. Beginning with the age division ten to fourteen years, the rate increases rapidly until a maximum is reached between thirty-five and thirty-nine. From age forty onward, the rate declines again, more or less, depending on the color and sex class, until the end of life. The decline in the death rate in the various age periods between 1911-1912 and 1919-1921 has been consistent with this characteristic age relationship of the tuberculosis death rate. Thus, we find that the greatest decline has occurred in the age period of thirty to forty years, at which ages the highest rates appear and the maximum service is probably rendered. Adults at these ages are more likely to benefit from educational propaganda and from institutional and other facilities for the care of tuberculosis. The foregoing facts may be put in a slightly different way, namely, that, in general, the rates decline most where the incidence of tuberculosis is highest, and least where the incidence is lowest. But these two statements do not conflict with one another; in fact they are closely related because where there is the greatest incidence there is also the greatest application of effort and the greatest desire for service. The two forces together bring about the very interesting results that are shown in the following table, which presents the death rates of 1911-1912 compared with those of 1919-1920 by age periods and the percentage declines at each one of these age periods.

A second special group of the population which has received more intensive tuberculosis service is the town of Framingham. I shall consider the results of this effort as they bear on the question at issue. In 1916, provision was made for trying out on an intensive scale in this town of 17,000 the various measures which are considered a part of the tuberculosis program. Every one of the chief activities was carried to its logical conclusion. Provision was made for the discovery of early cases, and for their care. Advanced cases have been carefully segregated and the contacts thoroughly instructed in their hazard. The whole community has been educated in the facts of tuberculosis, both as they apply in the home and in the shop. The larger part of the community has

Death rates per 100,000 from Tuberculosis of the Lungs (28, 29). Metropolitan Life Insurance Company, Industrial Department, 1919-1920 and 1911-1912 compared.

AGE PERIOD	1919–1920 DEATH RATE PER 100,000	1911–1912 DEATH RATE PER 100,000	PERCENTAGE DECLINE, 1919–1920 FROM 1911–1912 DEATH RATE
All ages one and over	132.6	197.1	32.7
1–4	17.9	28.3	36.7
5–9	11.7	17.9	34.6
10–14	29.5	34.6	14.7
15–19	140.3	159.7	12.1
20–24	219.2	300.5	27.1
25–29	223.5	351.6	36.4
30–34	224.9	369.7	39.2
35–39	220.6	392.2	43.8
40–44	211.8	342.6	38.2
45–49	194.5	280.1	30.6
50–54	178.8	258.2	30.8
55–59	161.3	230.4	30.0
60–64	153.8	213.8	28.1
65–69	160.3	192.5	16.7
70–74	143.3	188.5	24.0
75 and over	120.7	163.0	26.0
Total white	112.9	170.7	33.9
Total colored	280.1	373.5	25.0
Total males	137.2	228.0	39.8
Total females	128.8	171.2	24.8

been physically examined at regular intervals. Sanitary measures of every known type have been initiated and especially among school children. These are the key activities of the tuberculosis campaign, but, in Framingham, they were carried to the highest point. In the decade between 1907 and 1916, the Framingham tuberculosis death rate was 122 per 100,000; in 1920, it had declined to 65 per 100,000, about half the rate for the ten-year period preceding the work of the Framingham Demonstration. The prospect for 1921 is a much lower death rate than this latter figure. Up to June 15, there have been only three deaths recorded, on two of which there were doubtful diagnoses. Such is the character of the return, when the anti-tuberculosis campaign is truly carried out.

Has the query asked in the title of this paper been answered? Has it been proven that the anti-tuberculosis campaign has had an effect on the death rate? I believe the statistics submitted show conclusively that at least a considerable part of the improvement in mortality is directly

traceable to the spread of the anti-tuberculosis movement throughout the United States. There are probably other factors which enter into the improvement in the death rate. They cannot be considered here, nor is it necessary that they should. Of importance to us, as social workers, are the results — that our efforts for nearly two decades have not been in vain.

We can feel definitely assured that the work of the anti-tuberculosis organizations, in giving practical demonstration to the principles of the anti-tuberculosis movement, is having hopeful results. Proof is adequate that this is no time to let down the bars. Every phase of the anti-tuberculosis campaign should be maintained and enlarged. The future is hopeful and promising. With the researches that are being made in the laboratory and in the field, with the recognition on the part of officials and others as to the need of improving public health in all its manifestations, it is no exaggeration to say that we may hopefully and confidently look forward to the future in the belief that tuberculosis will be even further minimized and possibly eventually disappear.

REPORT OF A STUDY OF THE INDIGENT MIGRATORY TUBERCULOUS IN CERTAIN CITIES OF THE SOUTHWEST

By Jessamine S. Whitney

New York

INTRODUCTION

Scope and Purpose of the Present Report

The present report covers a first hand study in the following cities: Colorado Springs, Denver, El Paso, Phoenix, Los Angeles and San Antonio. The purpose was to get actual facts and figures concerning the number of indigent tuberculous being cared for by social agencies in a single year in these cities of the southwest.

Following the 1920 annual meeting of the National Tuberculosis Association in St. Louis, an experimental study was made in Colorado Springs to see if the method used in the present studies was a feasible one. As a result of that survey, the Colorado Tuberculosis Association wished to have a similar study made in Denver, and obtained from the National Tuberculosis Association the services of the writer for the last four months of 1920. During this period the Denver study was completed, being financed by the Denver Tuberculosis Association.

In December, 1920, the chairman of the Committee on Indigent Migratory Consumptives, thinking that further studies were advisable, asked the National Tuberculosis Association to continue the work in other cities. On a favorable vote of the Committee, the National Tuberculosis Association consented to this, and the other studies were financed by the National Association and by the states visited.

The El Paso records were obtained by Mr. George Granger in July, 1920, when he was field secretary for the Texas Public Health Association. The record forms which he used were similar to the ones used in the other studies, and the tabulation of them has been included with that of the other cities, although they were obtained at another time and by a different person.

Since the gathering of data was not completed until April 10th of this year, the present report can be only a summary of the salient points disclosed by the survey. It is planned to make a more detailed report for each city when time permits.

Sources of Information

It should be understood at the outset, that the data used were taken entirely from records of social agencies, therefore, only that inform-

ation could be obtained which had been made a matter of record by the agency.

The figures for San Antonio, Los Angeles and Phoenix, cover the calendar year 1920, and include all individuals who were cared for in any way by social agencies during that year. The figures for Denver, having been collected during the latter part of 1920, were for the year just preceding, namely, from September 1, 1919, to September 1, 1920. The Colorado Springs figures cover the year from April 1, 1919, to April 1, 1920; the El Paso figures were for the year June 1, 1919, to June 1, 1920. In every case where the year covered was not the calendar year 1920, the period taken was the year just completed at the time the study was made, so that the figures might be current.

Completeness of Study

It is undoubtedly true that some tuberculous individuals have been cared for by community agencies during the year covered who were not included in the study. It is also probably true, that in covering many thousand records of various agencies, a few records of tuberculous individuals may have been inadvertently omitted. On the whole, however, the figures presented are believed to be fairly complete and representative of the extent of the indigent consumptive problems in these various cities.

It should be borne in mind, of course, that all duplicate records in each city have been eliminated, and that the figures presented are the actual number of individuals, and not the number of records.

Degree of Indigency

"Indigent," as defined by the Committee on Indigent Migratory Consumptives, is a person who is not able to finance himself completely during the period of his cure. It is with this meaning that the word is used in this report. The degree of indigency, of course, varied greatly. Some persons needed only free medical or nursing care; others were in need of temporary aid; while many were dependent almost entirely upon the community for their living and care.

ANALYSIS OF FINDINGS

Total Number of Cases

In the six cities there was a total of 7319 tuberculous individuals cared for, wholly or in part, by the municipal agencies. This means, on an average, one indigent tuberculous person to every 155 of the entire population of those cities.

The proportions, according to cities, vary greatly, those cities having the smallest population, of course, bearing the greatest burden. Phoenix, with the smallest population, 29,053, has the greatest number of indigent tuberculous persons to the population, namely, 1 to every 58. Compare this with Colorado Springs, which is practically of the same size, 30,105, and has 1 indigent tuberculous to every 78 of the population.

El Paso has 1 to every 71 of the population; Denver, 1 to 156; Los Angeles, 1 to 186, and San Antonio, 1 to 264.

Unfortunately we have no similar figures of other cities, east or west, with which to compare them.

Length of Residence

There was a large group for which the length of residence was not stated in the records. This comprised nearly one-fifth of all the individuals recorded. The greater part of this group was from Los Angeles, where the county hospital record showed only the length of residence in the county, but not in Los Angeles proper. The material relief in that city, as well as the free hospital care, is financed jointly by city and county, so that the length of the city residence is not separately entered.

In the six cities 63 per cent. of all the tuberculous for whom length of residence was known had resided there less than two years at the time they applied to the agency.

Residence less than two years has been used to define a so-called "non-resident" in this report. Of course any division is arbitrary. I am inclined to think that any person who has resided less than three years should be classed as a migrant. If this division is made then 75 per cent. of all cases can be classed as "non-residents." In the Denver study, even among the 484 classed as residents (i. e., having resided two years or over), all but 73 had come originally as health seekers, or with a member of their family who was ill.

The proportion of non-residents varied from 83 per cent. in Phoenix to 36 per cent. in San Antonio. Los Angeles and Denver were about even with 64 per cent. and 68 per cent. respectively. El Paso is low with 47 per cent. Both the Texas cities have a small proportion of non-residents, so called. This is due to the fact that there are, in both places, a large number of Mexicans who constitute a big problem from a tuberculosis standpoint, but who have lived over two years in those cities, and must be classed as residents.

Five hundred and forty-five, or 16 per cent., of all non-residents made application for aid within a week after arrival, and one-third before they had been there a month; 50 per cent. before they had been resident three months, and nearly 90 per cent. when they had been there one year or less.

The women are either better provided for at first, or are more resourceful in placing themselves, since 38 per cent. of the men asked for assistance within a month after coming, and only 19 per cent. of the women.

Age Periods

The largest group is at the age period 25 to 29 — 1,000 or about one-sixth of all cases being of those ages — although the ten-year age period, 40-49, comprises almost as many, 975.

More significant is the proportion of tuberculous children in the various city groups. In all cities together, one-tenth were children under 14, and 10 per cent. of these were under 4 years of age. In San Antonio and Los

Angeles, nearly 15 per cent. were children under 14, while in El Paso, only about 1 per cent. In Denver and Phoenix, 4 per cent. were children.

Country of Birth

Only one-half (51 per cent.) of all the cases recorded were born in the United States, about 7 per cent. of them being Negroes. Twenty per cent. were Mexicans, found almost entirely in El Paso, San Antonio and Los Angeles. The largest proportion of Mexicans were in San Antonio, where they constituted practically one-half of all cases. In El Paso they comprised about 45 per cent., and in Los Angeles about 20 per cent.

In addition to the Americans and Mexicans nearly every country of the world was represented among the remaining 29 per cent., the Russian Jews being the only large group, constituting 9 per cent. of the total number. All these were found in the two cities, Los Angeles and Denver. Both have national institutions for Jews, although the one near Los Angeles is small. The two located at Denver, however, are large institutions.

Sex

Seventy-two per cent. of all non-residents were men, and 28 per cent. women, showing that it is the men primarily who roam in search of health.

Alone or with Family

But more significant than the fact that the large majority are men, is the fact that the men migrate alone, and the women more often with their family. Only 29 per cent. of the non-resident women came alone, while 70 per cent. of the non-resident men came without their family. The "homeless man", therefore, becomes the biggest part of the problem numerically. He was more in evidence in Denver, El Paso and Phoenix, while not so numerous proportionately in Los Angeles, San Antonio and Colorado Springs.

However, the extent of the added burden to these communities by the presence of other members of the family is not to be minimized. Taking all classes together, residents and non-residents who were with their families, there were 9315 other members of the immediate family living in the household, 5347 or 57 per cent. of whom were children under 16.

The non-resident group alone added 3238 other persons to the community, 1752 of whom were children.

Sources of Migration

We are able quite definitely from this study to fix responsibility for much of this migration. A few states are responsible for most of it. They are in order, Illinois, New York, Missouri, Ohio, Pennsylvania and Michigan. In the next group to the big six come Indiana, Kansas, Nebraska, Oklahoma and Minnesota, which, together with those already mentioned, furnished half of the migration to the southwest.

Texas and California were also given as legal residence in a large number of cases, but the latter only in the Los Angeles records and the former

for the Texas cities, so that in the case of both these states the migration was purely intra-state.

One-fourth of the migration to San Antonio was from other points in Texas. San Antonio also got more migration from the southern states, and also more Negroes than any other city.

Reasons for Migration

The only two cities in which the reasons for migration were made a part of the social agency records were Denver and El Paso. Of course records in this regard were not complete even for these two cities. However, in Denver all the non-residents, comprising 1036, said they had come seeking health in all but 38 cases. Even among the 484 in Denver classed as residents, all but 73 had originally come either as health seekers themselves, or with a member of their family who was ill. Considerably over one-half were advised to come by physicians.

In El Paso 61 per cent. of those for whom this information was recorded had come definitely on the advice of a physician. All but 84 of the 422 non-residents came seeking health.

Stage of Disease

The findings in this respect are not very accurate, as most of the records consulted were not medical. It must be remembered in regard to these figures that they do not represent the stage of the disease at the time the patient came to the city. It would be very illuminating to have such figures showing whether the climate was selected as a last resort, or whether patients were coming during the earlier and hopeful stage of the disease.

However, the records from which this study was made usually gave only a single diagnosis. These may have been made shortly after the patient came, after he had been here a considerable time, or whenever he could be induced to have an examination. Unfortunately, the records, except a few of the dispensary ones, did not show progressive diagnoses, so that we can learn nothing of the effect of the climate on the patient.

Wherever a definite diagnosis of stage of the disease was entered on the record, it has been so noted in this study. Usually no such specific record was made.

About 3 per cent. had tuberculosis, other than pulmonary. Of the pulmonary cases, nearly one-fifth were entered as third stage. These were evidently those cases which were so far advanced as to be obvious at the first clinic call.

Death Rate

As far as possible, the deaths which had occurred among these cases were entered on our records. Of those who moved away, or are otherwise untraced, nothing is known. For those who died in these cities, and in the case of a certain few who died within a few days after leaving, the ratio is one death to every eight cases. This ratio is the same

whether we take the entire tuberculous group, or the group classed as non-residents.

Present Disposition of Cases

What becomes of these individuals is, of course, of the most vital concern, and a test of municipal treatment of them.

The first fact which you will note is that the majority of them are lost sight of by the agencies concerned. Where and how do they live, and what do they do? These are questions that cannot be answered. For those who have resided over two years, and can be classed as residents of the cities, the query is the same as for those who are of a distinctly migratory group. Fifty-four per cent. were lost sight of, 13 per cent. had died, 10 per cent. were known to have moved out of the city, and 23 per cent. were still in the city at the end of the year studied.

Cost to the Community

The financial burden borne by these various cities cannot be exactly measured. As far as possible, however, the cost of all tuberculosis activities has been ascertained in each of the cities cited.

The results show that the highest cost per capita is in Phoenix, where the annual tax for each member of the community, man, woman and child, was $1.75 for the support and relief of the tuberculous. It is impossible of course in figuring expenditures to separate the cost of non-residents from that of residents.

The per capita yearly expenditure varies from $.22 in San Antonio to the amount mentioned above, $1.75, in Phoenix. El Paso and Denver carry approximately the same financial burden, the former being $.45 per capita, and the latter $.50. Colorado Springs, being smaller, like Phoenix carries a proportionately larger financial burden, the cost per capita there being $1.00. The cost in Los Angeles is $.31.

Facilities for Caring for the Tuberculous

None of these cities has anything like adequate provision, medical, relief, or institutional, for caring for the tuberculous, whether resident or non-resident. From what can be learned from the records, it would seem that there is no attempt at a coördinated policy or program of rehabilitation of the tuberculous anywhere. The material relief facilities of these cities are incapable of meeting, adequately, the problem of the indigent migratory consumptive.

Confirmation of Findings

It is of more than passing interest to note that the findings of all the cities taken together are very similar to those for the city of Denver, which has been worked out in greater detail.

The proportion of non-residents in Denver was 66 per cent., and for all the cities together, 63 per cent.

The same six states furnish the most migration to Denver, as well as to all the cities taken together.

The largest group according to age period is from 25 to 29, both in Denver and in the group of cities taken together.

Slightly more than half were born in the United States, both in the single city and in the group.

Seventy per cent. of the men were alone, and thirty per cent. of the women, both in Denver and in the six cities taken together.

In Denver the ratio of deaths was 1 to every 7 cases; in the group the ratio is 1 to 8. In both Denver and the group taken together the same proportion of non-residents were men, namely, 72 per cent.

These similar findings in a single city and in all the cities taken together seem to show that there is a definite problem which follows certain definable laws.

NURSING SECTION

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DES MOINES

INDUSTRIAL NURSING AS A MEANS OF FIGHTING TUBERCULOSIS

By Lee K. Frankel, Ph.D.

New York

I have come here this afternoon without any prepared address because I thought it would be a much better method if we could just have a heart to heart talk and have an opportunity of thinking out loud on a subject which is a comparatively new one and about which we know very little. As a matter of fact, we have no definition as yet, as to what we mean by industrial nursing.

I am going to take the liberty of dividing up what I have to say into two distinct parts. First of all, the work is done by the industrial nurse as she is generally understood; that is a nurse attached to or connected with some large industrial plant where it is her business and part of her duties to look after the employees of the establishment, in connection with the hospital or clinic connected therewith and, as occasionally happens, to look after the interests of the employees in the employees' homes.

In addition to that, there is a comparatively new line of industrial nursing that is not done by the individual plant nurses, but which is being done more or less extensively today throughout the United States, and Canada as well. I refer to visiting nurses' associations giving bedside care, which are, as a matter of wise enterprise, making contracts with industries or occasionally with insurance companies through so-called group insurance, under which they look after the welfare of employees who may be insured under such policies.

All that we will attempt to do today is to find out what is the philosophy of industrial nursing. To my mind, this subject should not be limited to the work of the industrial nurse in the fight against tuberculosis but should be broader and more generally regarded.

With the industrial nurse in the fight against disease, tuberculosis is simply one of the manifestations of conditions in industry. Tuberculosis is a disease which may come from other causes. There may be social conditions which produce it as they likewise produce other diseases. Not only industrial environment, and sanitary conditions in the factories, but sanitary conditions in the home and previous illness of employees all have a general bearing in the fight against tuberculosis.

In discussing this matter, we might as well look at it from the broadest standpoint and determine what is the function of the industrial nurse, not only in the fight against tuberculosis but in the fight against disease and particularly in the fight for the prevention of disease in industry. Now,

of course, we might say that statistics were necessary in order to show to what extent industry was responsible for disease. No one will deny for a moment today, as a result of inquiries by the Government and other authorities, that there is a very distinct relationship between certain types of disease and the condition of the plants in which people work.

It is not quite clear today as to what extent conditions in industry bring about tuberculosis. I think statistics will show that there are certain specific diseases which can be laid directly at the door of certain industries. In the development of better industrial relations, more and more employers are beginning to realize that it is a matter of wise business to give ill employees necessary service. More and more employers realize that it is a part of the function of industry to look after and care for the physical welfare of employees.

There are questions which arise as to the duties of the industrial nurse. What is she to do, particularly in regard to her work with physicians? In the development of nursing in the larger industrial plants, it may be safely said that the physicians came first. The first thing that the employers did was to employ physicians to look after the welfare of their employees. Subsequently nurses were engaged to carry out the instructions of the medical directors of the plant and to help them in their work. On the other hand, there are industries in which there is no medical direction but in which a nurse has been placed in charge to look after the welfare of those entrusted to her care.

When we come to the question of the work being done in industry by the industrial nurses or visiting nurse associations, we meet an entirely different situation. There is a rule of nursing associations that no service may be given by a nurse unless a physician is in attendance. The family physician may have no relationship whatever to the employer. In these cases it is not the physician but the nurse who makes the contact between the physician and the industry.

There are other implications today contained in industrial nursing, or as I prefer to call it, public health nursing in industry. The public health nurse in industry is, to my mind, the educator. Her fundamental task is to educate not only the employee, but the employer as well. There are certain things which the nurse and the nurse alone can do (and I say this with all due respect to the medical profession). The nurse will have to meet responsibilities in industry which will be hers, rather than the physician's, because she has the possibility of making intimate contacts in the home, which are given to but few people. The relation of the nurse with the family will necessarily become very intimate, much more so as a rule, than in the case of the physician.

This gives the industrial nurse a remarkable opportunity. It is an opportunity for coming in close personal contact and close personal friendship with her patients and their families. It is a relationship in which the family practically places itself in the hands of one whom they consider to be one of them. It is because of this trust that the nurse is enabled to carry on educational work in the home, which is so necessary today, if we

are to carry on, not only the fight against tuberculosis, but the fight against all disease.

The value of a nurse depends upon her ability to accomplish certain things. We believe that we are developing today a rational and sane method for reducing tuberculosis and that is just as true anywhere else as here. The opportunities in industry are much more pronounced than they are in a general community. We are all convinced that what industry must do with its employees is precisely what it does with its machinery and stock. There is no employer today, there is no manufacturer with whom you are connected, who does not consider it essential in his business to take a periodic inventory of materials and machinery. No man would run along year after year without knowing how much stock he has on hand, how much depreciation there has been in the machinery, or without knowing at the end of a year how much he is worth or how much there is to his credit or the reverse.

Industry must be taught that the same thing holds true of human machinery and that a periodic inventory must be taken of it in precisely the same manner that an inventory is taken of other commodities.

Industry will do this when employers realize this fact which has not been brought to them. Industries have grown so large that frequently employers are no longer able to make personal contracts with their workmen and do not know the condition of their human material. I should say that one of the great functions of the nurse in industry is to adjust her work so that she can bring home to employers the need for periodic medical examination.

The objection to such examinations has not come primarily from employers. Frequently objection has come from the workmen. They are suspicious and fear that in certain instances such examination may mean the loss of their positions. It is the tactful nurse who can go into the employee's home, and, in nursing his wife or children, can bring to him the realization of what physical examination means. She can make him see that it is something for his benefit and not necessarily for the benefit of the employer.

It is the nurse, whether she comes into the man's home through the industry or whether she comes in through the visiting nurses' association, who has the opportunity of carrying on educational work, of preaching the gospel of better health and the fact that people need not necessarily suffer from disease. She can probably instill into the minds of thousands of employees the thought that reasonable coöperation with employers in their welfare efforts will redound to the benefit of the employee.

Another great value of industrial nursing is that the nurse is able to teach the employer. I think there is nothing more pathetic in industry than the fact that during the last century employers have drifted apart from workmen. This is possibly a result which could not be prevented. In the old days, if a man worked at a bench as a shoemaker, he made the entire shoe; he didn't make part of the shoe. When he wanted help,

he took in an apprentice. That apprentice lived at the home of his employer, studied under him and learned the trade under him, continued to work under him and very likely married the daughter of his employer and at the death of his employer, carried on the business. You can see that condition today in England and in other European countries. You can see signs out in front of stores or houses advertising shoemakers, saddlers, bootmakers and other trades which have been there for generations; one after another of the members of the family have come into possession of the business.

With the introduction of machinery, that was all changed. Today we have great, large industries where the employers are very much detached from the employees and it happens only too frequently that the employer has no knowledge of conditions in the homes of his employees. The instances are only too frequent where men come in to work and are accused of listlessness, indifference, or of soldiering on the job, as it is called; where they turn out bad work and ruin work and are kicked out or fired. The employer may not know that such indifference or listlessness may have been caused by sickness in the employee's home and that he may have sat up nights nursing a sick wife or child. It is the industrial nurse who goes into the homes who sees these conditions, and who knows the intimate secrets of the home. It is the business of the industrial nurse, primarily, to bring to the knowledge of employers the home conditions of the people whom they employ; to know their habits, to know their needs, not merely during the eight hours of work but the conditions as they exist in the homes at all times.

Today industry must know these things because if industry doesn't industry cannot be properly regulated. The employer with a conscience and who looks into the future, knows the conditions which exist in the homes of the people whom he employs, as well as the conditions which exist in his own plant. In the future it will be the industrial nurse who will be called on to watch conditions in factory and mill, in industry itself. If conditions are unhygienic, or unsanitary, if there are swamp-spots around the factory, if men are overworked, if hours are too long, if women are working under conditions which are bad for women or if any other conditions exist, the industrial nurse will have an opportunity to see and study these things, because she is there on the job.

I consider this to be the duty today of the industrial nurse. In addition to her purely professional activities and responsibilities, it is her business and part of her profession to bring home to industry a realization of industry's responsibility. It is part of the duty of such a nurse to see that industry takes proper care of its employees, not only by seeing that their homes and surroundings are proper, but that they get proper food, live in decent houses and have time for rest and recreation. It is also her duty to see that there are sanitary conditions in the plant and that the safety conditions are at the maximum.

When we can get these things, when the nurse can get into a right relationship with the employer, get his sympathetic coöperation and good-

will and make him see the larger vision of his relationship to his employees, then we are going to see among the early results the introduction of periodic health examination. The inevitable result will be that we are going to find cases of tuberculosis that are unknown today. We are going to find early treatment and every probability of cure.

Nothing is as clear as the results of the Framingham experiment. It was shown, as a result of examinations conducted there on two-thirds of the population, that the number of cases of tuberculosis which were known was entirely too small. We are not beginning to reach all the early cases, the advanced cases or the incipient cases, and the only way we are going to do this is by means of these periodic examinations. With the proper desire on the part of employer and willingness on the part of the employee, we are going to save hundreds of lives — thousands of lives — in this country if we can find in industry the early cases of tuberculosis.

I do not believe there is anything of greater satisfaction to the officers of the company with which I am connected than the realization there are working at No. 1 Madison Avenue, New York, approximately 275 employees, all of whom had tuberculosis. They were given treatment in the company's sanatorium and today are back at work. They are likely to live for many years to come by reason of the fact that the effort was made to find them in the earliest stages of the disease and give them treatment when their condition was still hopeful. In other words, the company compelled them to undergo a medical examination periodically. Our nurses go into the homes of our employees. They find those who are ill or broken down, or weary, or tired. When they return to work the nurse sees to it that they are examined. It is in this group that we find many of the early stage cases. It is these whom we sent to the sanatorium and eventually returned 85 per cent. of them with the disease corrected.

Last winter, when I was in the South, I was amazed to find in one large community a great big industrial plant employing fifty doctors of its own and a large number of nurses and having a hospital on which it was spending one million dollars for the care of its employees and seeing that every man, woman and child (including the wives and children of the employees), were given the proper attention and seeing to it that the nurses were going into the homes, not merely when sickness was there, but at all times. They watched the families and gave them just as much attention, just as much care and just as much thought as we have been in the habit of giving, during the past years, to our live stock — cattle and pigs and other things which seem to have more material value. Every nurse employed in that industry realizes not only her great responsibility but her great opportunity.

I hope you women can see the vision of the future, the possibilities that lie in your hands for the improvement of the public health. I hope you realize the responsibility of going out among the people entrusted to your care and gaining their confidence and goodwill and giving them words of advice which will mean health to them. When you can get your people to do the things they ought to do, when you can get hold of them in such

a way as to cause them to trust you, then you are going to find the early cases of tuberculosis and the conditions in the home or factory which bring it about; then you are going to see that cases get proper treatment at the proper time. Then the industrial public health nurse will be doing everything in her field in the fight for the eradication of tuberculosis.

DISCUSSION ON PAPER BY DR. FRANKEL

Miss Susanne F. Robbins, Bradford, N. H.: Having been connected with one of the earliest tuberculosis associations and also having been one of the pioneer industrial nurses, I may be able to give a word of encouragement to nurses who are doing this type of work, which should also mean that they are doing tuberculosis work in a greater or less degree. The pioneer industrial nurses were invariably considered spies; because of this I hesitated before I consented to enter the employ of one of the largest organizations in this city. The company assured me of their support and that I should be given every chance to help the employees, and this promise was always kept by the Metropolitan Life Insurance Company. During the time I was with them the medical rest room was opened: to that room came the employees whenever they needed medical treatment or advice of any description, and through that room was the opportunity for detecting tuberculosis in its earliest stages. As I was thoroughly interested in tuberculosis work and had been doing it for several years, whenever a clerk came to the rest room looking weary and wan, telling of loss of appetite and weight, with possibly other symptoms, I thought of tuberculosis at once; in fact some of the physicians said I insisted that they find tuberculosis. It was easy to pick out the suspicious cases also and watch them, thus doing preventive work as well. Because of the large number of these "suspects" the morning and afternoon lunch developed and at the present time there are 290 employees taking this lunch, not all I think, suspicious cases, but those who need building up so that they will not become so. Later when the company's sanatorium was completed, because the nurse had "paved the way" there was little difficulty in getting the patients interested and willing to take the treatment. The members of the families who were worried often came to the nurse for encouragement and after being reassured were often given hints and advice in matters pertaining to the health and protection of others in the home. Given these opportunities of contact I cannot emphasize too strongly the wonderful influence the nurse has for good, and for good health.

Later as I went to one of our southern states to organize community service in a cotton mill village, I found the same opportunity awaiting the nurse. The people in the villages have their own cottages each with a garden plot and plenty of light and sunshine. The sanitary conditions, however, are still bad in many places, but these are rapidly being changed for the better, and the living conditions soon will be exceedingly good. The nurse has a greater opportunity for detecting tuberculosis as she

often is the only one interested and there are seldom other agencies to help her. She may often become discouraged before she can establish the certainty of her suspicions, so loath are the family and often the physician to admit the fact. Just one instance almost proves the need of an industrial nurse in every mill village. I was asked to see a family that had arrived the evening before from the mountains "back yonder — beyant Murphy." They were all ten in bed with influenza and four proved advanced cases of tuberculosis.

Many of the employees in the cotton mills come directly from the mountain districts where they have had no social life. Having lived by barter and practically without money, they are suddenly able to earn what to them is undreamed of wealth. Without traditions and moral stamina they often become dissipated and are in condition then for contracting disease. Instruction and oversight by the nurse may be the means of preventing such circumstances, and North and South the effect of her efforts may be limitless. If physicians do not seem to appreciate your efforts at once continue to make them so worth while that they can't ignore them or you. Unless there is regularly connected with the business plant a physician, it is difficult to introduce the yearly or semi-yearly physical examinations which are of so much benefit to the employees and enlightenment to the nurse. Nurses need never be in doubt of the support of their employers, if they do their work faithfully and tactfully.

Dr. M. J. Fine, Newark, N. J.: In regard to the question of tuberculosis among industrial workers which Dr. Frankel has discussed, there have been investigations and examinations conducted in Newark which are similar to those of the Framingham demonstration.

We conducted an examination of food handlers and such people as cooks and waiters. We found a considerable number to be affected with tuberculosis, and about seventy-five per cent. of those are now in sanatoria. We also investigated plants in Newark where girls are working and found six cases of tuberculosis within one year in one plant. That shows the necessity of every plant having a physician to find out the physical condition of employees.

From the examinations which we conducted among food handlers, we found that many of them, knowing that they had tuberculosis, never came for examination, but voluntarily gave up their work.

Examinations have also been conducted of a few hundred boys attending the continuation school and I would say about fourteen active cases of tuberculosis have been found.

TUBERCULOSIS NURSING BY SPECIALIZED STAFF

By Mary E. Edgecomb, R.N.

Providence, R. I.

Where the medical profession has led, nursing has ever followed.

Specialized tuberculosis nursing was the inevitable response to the widespread interest in tuberculosis by physicians, which led to their forming in June, 1904, the National Tuberculosis Association. The objects of the Association were:

First: The study of tuberculosis in all its forms.

Second: The dissemination of knowledge about the causes, treatment and prevention of tuberculosis.

Third: The encouragement of preventive and scientific treatment of tuberculosis.

Professor Adelaide Nutting,[1] in an article printed in April, 1904, said: "During the year 1903 a new interest in the care of tuberculous patients had been aroused in existing societies, and in two or three cities nurses are devoting themselves wholly to the visitation of tuberculous patients in their homes. The various district nursing associations of the country have for some years given care and instructions to the consumptive patients, who come under their charge in the rounds of daily visits.

"The specialized work, however, of house visitation of the patients by individual nurses is practically a new idea and clearly an outgrowth of the great impulse set in motion by the medical profession in its war on consumption."

The machinery put in motion by the National Tuberculosis Association has led to the building of sanatoria and hospitals — from 96 in 1904 to 600 in 1918; the development of tuberculosis dispensaries — from 24 to 600; the establishment of 3000 open air schools and classes and 15 preventoria.

The work has been changing in character. The neglected advanced consumptive is no longer our biggest problem. We still meet him occasionally, but the work is mainly with the earlier, hopeful case, with more and more emphasis on prevention and education.

We, as nurses, have been a part of this campaign. When clinics are established it is the nurse who feeds the clinic, who goes into the home and interprets medical advice into terms the family can understand. When the patient is recommended to the sanatorium it is the nurse who follows the patient to see that he goes, to see that it is made possible for him to go. Tuberculosis is no simple medical disease that runs its course

in a few weeks, but a big, many-sided problem that extends over long periods, touching not only the medical, but spreading out into the social and economic conditions, habits and environments, including not only the patient, but his entire family. It covers the intensive work to be done with a new case; the careful detailed instruction; the time consumed in conferences with those agencies interested; the working out with those agencies of a plan for the family; following exposed families to persuade them often against their desires to have the routine examination necessary to detect any disease in incipiency. It means the investigation of death returns, the following any clue that leads to a case or suspicious case of tuberculosis, the making of surveys and studies that will demonstrate to ourselves and others where we stand.

All this work, by its very nature, is impossible to fit in to the day of the general nurse, busy with her acutely ill patients, with the desperately sick pneumonia, the fresh obstetrical, the surgical dressing, the pathetic chronic who depends so much on her regular treatment. All these calls are so urgent that advisory work must inevitably suffer.

The city of Cleveland tried the experiment of generalized nursing in a small district from 1914 to 1920, then the district was turned back to the Visiting Nurse Association. The annual report of the Visiting Nurse Association for 1920 said this: "The city did not consider this experiment a failure, but realized that they had too few nurses to do a good piece of work. It was either the neglect of the preventive work or bedside care, and as these nurses were primarily for preventive work it was usually the bedside care that suffered, and (here it seems to me is the important point) until the time comes when the city has the right proportion of nurses to the number of people, generalized nursing cannot be wholly successful."

We are all specialists by nature. Very few of us do many things equally well. In our work and our play we do best the thing we like to do. Some nurses are doing institutional work, some like public health nursing. Not all of us like to teach or can teach, and advisory work is essentially a teaching job, and like all teaching requires a definite knowledge of the subject taught. And no one appreciates this more than a district patient.

Industrial nursing, school nursing, child welfare, venereal disease still need study and concentrated effort. In tuberculosis work we have definite things yet to accomplish. Our work is not standardized. Bedside care is a definite procedure with carefully thought out technique. We could go from one part of the country to the other and work with almost no change of method. When we say general care, we talk a common language. But have we standards in tuberculosis work, uniform methods. How do we admit contact cases? How long do we carry an apparently arrested case? Have we uniform record cards or fairly accurate statistics that we can even compare our work?

What are we teaching our new nurses?

Until tuberculosis is included in the curriculum of every training school with possible sanatorium affiliation and the nurse who graduates knows as much about tuberculosis in its early stages as she does about every other

common medical disease; until every public health course includes tuberculosis in its relation to other diseases and social conditions, we cannot let go of the educational advantage of specialization.

For the nurse who is working alone it is an advantage if she is able to go to a larger organization and have a month or more intensive work in the line she most needs.

There are larger interests that we as tuberculosis workers must push, legislation to work for. I do not believe we have yet used to the fullest extent the material concerning tuberculosis in relation to all sorts of medical, social and economic conditions that we as nurses going into the homes have just under our hands.

I do not think for one minute that the nurses doing general work are not interested in just these things concerning tuberculosis. They are, but they have not the time, and the needs along other lines are just as urgent as these. With an equal interest in all one loses the force and enthusiasm that the definite purpose gives.

Perhaps the great part of tuberculosis nursing must always be done by general nurses. Each place must know and supply its own needs. In the rural communities and small towns and cities where nurses are working alone or in small groups, there will always be the nurse giving bedside care to the sick and doing everything that comes to her hand to do, and on a solid well-built foundation of general work must specialization be built. I feel there is still a definite place for the nurse doing specialized tuberculosis work.

In a larger town or city where the demand for bedside care is so heavy that it leaves little or no time for advisory work, and where there are a considerable number of known tuberculosis cases, it makes for uniformity to have those patients under a special supervisor whenever they can be carried as a group in coördination with other nursing work either under state or municipal supervision or a public health nursing association.

Specialized nursing service has been carried on more or less successfully for some years in one city of about 239,000 inhabitants. Under the board of health are the school nurses. Under the Visiting Nurse Association the staff is divided into services, general bedside nursing, child welfare, venereal disease and tuberculosis. The group doing tuberculosis nursing attend clinics, do the school nursing in the fresh air rooms, do investigations for the sanatorium, do all that pertains to advisory tuberculosis work. If continued bed care is needed, it is given by the general nurse in that district. The case is always admitted by the tuberculosis nurse who has the patient constantly under her supervision, making visits very frequently and always giving bed care the day she visits. The bed care is not much of a problem, however, because of the adequate sanatorium and hospital facilities and the apparent willingness on the part of most patients to accept treatment. All forms of tuberculosis are admitted to the tuberculosis service. The cards are different in color from those of the other services and have the particular information needed for tuberculosis records.

The district nursing staff numbering fifty report at a central office every morning and the cases of common interest are talked over. There is practically no overlapping either with the other services or with the board of health nurses. With good coöperation there need be no duplication of work. There may be two or three nurses who cover the same territory, but the advantage to the patient of expert advice is to be considered.

The number of cases that can be carried by a specialized group must vary with the size of the district, congestion, car service, etc. In a fairly congested section of the city with a clinic and a fresh air school, a nurse could carry one hundred cases. I realize that seldom, perhaps, is this ideal attained.

We are hearing much talk in the medical profession about preventive medicine and community health, but we still need our specialist. I believe Dr. Athel Campbell Burnham[2] has given us the reason when he says, "During the past fifty years, there have been vast changes in the medical science. . . . The known facts have increased so rapidly that it is impossible for any man to master the details of all branches of the profession." I have heard unofficially that when Miss Goldmark's report comes out, the advantages of generalized nursing will be presented. Such a report must be considered and is bound to have an effect on public health nursing.

What the future will bring us, we cannot tell. The pendulum swings from specialization to generalization. Underlying it all is the great unity of purpose, the health of the public.

I do not believe we begin to realize all that lies just ahead of public health nursing either in opportunity or achievement.

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TUBERCULOSIS NURSING BY A GENERALIZED STAFF

By Anne Sutherland, R.N.

New York

The subject of generalized nursing versus specialized nursing always comes up for discussion where two or three nurses are gathered together. With each successive gathering there are new evidences of a general tendency in the field of public health to correlate closely related activities. The National Child Health Council is composed of all national organizations interested in the child. The Baby Welfare Federation of New York City is composed of two hundred and ten agencies engaged in some form of child welfare; the number alone indicates how this Federation might function to prevent duplication of effort.

We now find when communities wish to develop another type of health work, they first make a survey of existing agencies to see the one best equipped to extend its service to cover the new field and thus avoid another organization.

The business man is interested in public health. To retain his interest and support we must follow the same methods in our nursing work that he does in the office and factory, namely: study how to reduce overhead and personnel with a corresponding increase of accomplishment.

In the campaign for public health the place of the nurses is undisputed. The demand for nurses far exceeds the supply, due to the very rapid awakening of public consciousness to the importance of safeguarding health. It then becomes our responsibility, as a profession, to do the utmost to organize our forces, so as to make our contribution as great as possible.

At present there are several nursing organizations developing a generalized nursing service, so that we will soon have data as to cost, the number of families a nurse can visit, and practical points in administration, which with modification can be applied to other communities.

It is difficult to think of any form of public health nursing in which the nurse can confine her health teaching to any age group or to a member of a family with a specific disease. Our unit must be the family. This applies, particularly, to tuberculosis nursing; the patient must be given every opportunity to recover and keep well, but our great concern is to keep the resistance of the contact cases to the highest possible point. The children under four or five years of age must receive special attention, as at this time they have so little resistance to the infection of

tuberculosis. The nurse, doing good tuberculosis nursing, actually does generalized nursing although we may not recognize it as such.

In considering tuberculosis nursing by a generalized staff, one immediately has to think whether the nursing is under the direction of the official or of the private organization. The startling death rate, prevalence and infectiousness of tuberculosis makes it a community problem. The recognition of this fact is becoming wide-spread, so that our departments of health have appropriations for tuberculosis work.

We will first consider that our staff of nurses is under the department of health. As we now interpret the function of a department of health as that of prevention, rather than treatment, our official nurse cannot do curative nursing, any more than can our health officer prescribe for the pneumonia patient.

Our municipalities provide hospitals for the acutely ill, and when the congestion due to lack of adequate housing is as serious as now, few tenements houses can afford a separate bed for a patient, while a separate room is quite out of the question. As part of our teaching program, we must advise the use of hospitals, with their splendid staff of physicians, with their laboratory, x-ray equipment and other facilities for diagnosis and treatment.

Let us consider the types of nursing that might be necessary in a family where there is a case of tuberculosis.

a. For the care of the patient.

Teaching the patient how to follow the physician's instructions and necessary precautions to safeguard the family.
Arranging for hospital or sanatorium care.
Follow-up work on discharge.
Procuring suitable employment.
Reregistering patient with physician or clinic.
All bedside cases should be in an institution; if persuasion fails, a member of the family will have to be instructed how to give this care. We must always remember that one of the best methods of teaching is by demonstration, and the instructive nurse cannot go into any home and keep her gloves on. She may have to give the actual care several times before the lesson is learned, and then careful supervision and encouragement is necessary. Can any mother learn how to bathe her baby except by seeing the nurse do it, and then bathing it while the nurse observes? Teaching of this kind lasts, and I have seen a mother bathe the second baby perfectly, because her nurse for the first baby taught her so well. No matter how perfect the care we give a patient it will not do for the twenty-three hours between visits. We must instruct some person what to do during our absence.

b. For the care of the family.

Teaching good health habits to all in regard to food, rest and personal hygiene.

Prenatal care for the mother when necessary.
Supervision of the well baby.
Securing preventorium care and summer vacations.
Registering children in fresh air classes.
Periodic examinations.
Arranging for correction of defects, particularly those of the teeth, which have such a direct influence on the general health. Malnutrition, too, is found in many of the children in these families. To correct this we must be sure there is an adequate food allowance, that all physical defects are removed, that the child has sufficient rest and lives under as good hygienic conditions as possible. There must be intensive follow-up work, until good health habits are established and a satisfactory gain is made.
The periodic medical examination for both children and adults, regardless of known exposure to tuberculosis, is of the greatest importance in our prevention program. This is one form of health teaching that appeals to men; they know that machinery to do good work must be thoroughly inspected at regular intervals and the parts showing evidence of wear repaired before a breakdown occurs, and they can see how the same principle applies to their health. In an Italian community where our association has a community house, one men's club, with a membership of nearly nine hundred, supports a diagnostic clinic for their members. The second man examined, a barber, was found to have incipient tuberculosis; hospital and country care have made him a wage-earner again, although we still have him under supervision.
Making social readjustments particularly in regard to relief. Relief must be adequate or our whole health program fails. The nurse, with her intimate knowledge of the health situation, must so present these facts to the relief agencies, that adequate relief is given and for a long enough period.

Our program includes prenatal, infant welfare, pre-school, school and adolescent care, — care for contagious and venereal diseases can be included when necessary.

Can we not think of this service applied to a small area perhaps with a population of two thousand? Some families, those with one child for instance, would require comparatively little time of the nurse.

If the nurse works from a center accessible to her district and has a conference hour, she will soon find her mothers coming to her if anything unusual occurs in the family. This reduces the number of home visits. The first patients would probably come from the diagnostic clinic, but the appreciative mother soon becomes the source of new cases, as one woman said when she brought the newly arrived little Italian mother to the prenatal clinic, "You done me good, do good to her."

When the tuberculosis nursing is done by a private organization, there must first be established a definite connection with the department of

health to which has been delegated the responsibility for community public health. In addition to the types of nursing our educational nurse would do in the family, we could include a maternity service, consisting of attendance at time of delivery and bedside post-partum care; also, nursing for acute illness.

With the addition of this bedside care, we must safeguard our prevention program by being sure the nurse actually has time for teaching. A mother who has reached the convalescent period is so appreciative and ready to follow advice, that we must be sure the nurse will not have to leave her because she has so many sick calls.

At a time of family crisis we cannot do much teaching. It is hard to divert an anxious mother from thinking of Johnnie, who is in the hospital with pneumonia, to the value of a periodic medical examination for the children apparently well.

Put the man who is out of work in touch with an employment bureau; then when he is at work try to add the extra quart of milk to the food budget. Securing attention is one of the first requisites for good teaching.

The advantages usually claimed for a generalized program are these: less time required for transportation; less duplication of history-taking and record-keeping, thus allowing the nurse more time in which to give nursing care; the confusion and bewilderment saved the mother by having so many nurses entering her home; the opportunity for a nurse to know the whole health situation in a family; the opportunity for the community to know the one nurse so intimately that they come to her with all their problems at a time when some simple remedy may prevent a serious illness later.

But there is also a distinct gain for the tuberculosis program. The nurse, responsible for tuberculosis, is the one who comes in contact with the under-weight mother, who feels so unfit and needs a vacation; with the rachitic and under-nourished child, who sometimes has pneumonia twice in the same winter; these are all under her observation, and are treated as the potential case until they reach a margin of safety.

The nurse, with her busy days, cannot attend conferences and read articles on all these subjects. She very easily might over-emphasize one phase of the work, and not make wise distribution of her time. So, we need our supervising staff, composed of specialists in the different branches of public health nursing and dietetics. They can familiarize themselves with the new developments in their particular field, and be responsible for the standard of work.

With the present shortage of public health nurses, it is difficult to maintain a staff of nurses well trained in all these lines. But, if a nurse firmly believes in preventive nursing and enjoys teaching, the supervisor will not find it difficult to teach her how to apply this principle to each so-called specialty.

The nurses find this service most satisfactory. It is hard to transfer the mother with the new baby to another nurse. The mother feels you

are deserting her, and the nurse knows she has reached the point where the mother will readily follow her instructions in regard to the baby. When the opportunity comes to the nurse to render another type of service in a family, we find her not thinking of it as additional work, but as an additional opportunity to teach the whole program of positive health.

You might be interested in the tuberculosis nursing done in our association, which, as you may know, is both a relief and health organization.

Families which are referred to us for relief and in which there is tuberculosis come under the care of our tuberculosis nurses who, besides doing generalized instructive nursing, also give the relief.

The advantages are: the family has one adviser for both medical, social and financial problems, — the assurance of medical and financial support for a family is a strong factor in persuading sanatorium care for the wage earner — and the saving in cost due to the association's having one worker rather than two enter the same family.

Our nurses have to learn the principles of relief giving, and are directed by a nurse with long experience in relief work. The nurses do the relief work to the entire satisfaction of those who are experts in this field of family welfare.

It is not considered wise for public health nurses to give relief, and I am not advocating it; but in our association it is an efficient and satisfactory method of doing our tuberculosis work.

DISCUSSION ON PAPERS BY MISS EDGECOMB AND MISS SUTHERLAND

Miss Bernice W. Billings, Boston: In trying to decide whether generalized or specialized tuberculosis nursing brings better results, it seems to me we must consider the locality in which that work is to be carried on. In the little towns it is out of the question to employ specialized tuberculosis nurses. The nurse engaged in generalized nursing must be the one to follow up the tuberculosis patients. Provision should be made to have state and county tuberculosis nurses visit the rural nurses as often as possible to stimulate their interest in tuberculosis work and to give advice when needed.

In the cities, particularly the large ones, it will be impossible to carry on adequate tuberculosis nursing in a generalized nursing program for many years. It would take many more public health nurses than we now have to generalize the nursing in these cities, and really give good care to the consumptive patient. We all know that in generalized nursing, when the work is heavy, it is the chronic case that suffers.

Miss Margaret G. Weir, Beverly, Mass.: I have very little to add and there are two sides to the story. In a large city, I think, as does Miss Billings, that we are a long way from generalized nursing. The small city and the rural districts very often have to depend entirely on the generalized nurse, and in generalized work much depends (not all, but a great deal), upon the kind of woman we can get to begin with. I have a very

serious feeling that the tuberculosis work suffers in generalized work because with the average generalized nurse, tuberculosis work comes last. I have specialized in tuberculosis work for the last eleven years so probably my heart is very near to the tuberculous, but it always appears to me to come last in general work. I have heard several speakers during these last two days talking on tuberculosis, and every time they advocated generalized work I felt like asking them how much time was given to the poor tuberculous patient. While Miss Edgecomb was talking, I could not help but wonder how much instruction in the homes her nurses gave. What I mean by that is: How much time does she put in with one member of the family or more than one member of the family, teaching them how to care for their own sick?

I am in a small city of about twenty-three thousand and I find that the district nurse, when she is very busy, sometimes has the advantage of working with one or two pupils from the hospital, but when the hospital is busy the district nurse has to do all the work. This means that I have to give bed-side care to cases when the pupil nurses have been unable to see my bed-side case.

However, I do not give these pupils bed-side cases now; I do them myself. In practically every case I visit, when bed-side care is necessary, I find one member of the family who is intelligent and interested. That one is made to realize the fact that he or she has been instrumental in keeping the sick member away from the hospital, and that we do not approve of this. I never forget that we have to reconstruct their ideas concerning the hospital. In Massachusetts we have splendid hospitalization.

I never cease to emphasize the fact that the patient is going to get much better care in the hospital than in the home. My job is not to go to the homes every day and take care of these people, but to see how well it is done by the family. It is the job of the family to take care of their sick. Usually they fall in line with my suggestion concerning the hospital and tell me that it is a great deal of care and they didn't like to do this or that, and have decided that the best thing they can do is to let the patient go to the hospital.

My feeling is that we are a long way from deciding which is best—generalized nursing or specialized nursing. I think as far as tuberculosis is concerned the specialization comes first, but I also feel that the biggest feature we can put over is to train every nurse to know a little bit more about tuberculosis. I feel that the nurse who knows tuberculosis well knows every other phase of the public health field.

Miss Edgecomb: Perhaps I did not make myself quite clear about turning cases over to the general nurses. The bedside nursing and all tuberculosis nursing is done in Providence by the Providence District Nursing Association. Calls come into the office and every tuberculosis case is referred to the tuberculosis nurse who makes the first visit. If continued bed care is needed it is given by the general nurse in that district who is in daily touch with the tuberculosis nurse. Frequent visits are made by the tuberculosis nurse who gives bedside care on the day of

her visits. The case is admitted and carried by the tuberculosis service.

Miss Virginia Chetwood, Hackensack, N. J.: I am seeking information. In Bergen County, New Jersey, we have some purely residential sections, some that are rural, some industrial sections, and also a combination of residential and industrial. About ten towns have school nurses. The only visiting nurses are the Metropolitan and two Red Cross nurses. When a patient with tuberculosis comes to us, it has been the habit to make the family the unit of work, as we considered this patient one of the best means of reaching the home. Our effort is to bring that family as near as possible to physical efficiency, not merely confining our work to the tuberculous patient. I do not know whether this is generalized or specialized work, but I think we should be falling down on our job if we sent the patient to a sanatorium and considered our work done. I look on the patient as the entering wedge into the home. I would like some advice on this subject.

Miss Chloe M. Jackson, Atlanta: I believe that I can answer some of the questions. In the first place, I want to speak about specialized nursing in groups. We have in one nursing group a staff of specialized nurses and a staff of generalized nurses. In one of our communities we started general work and after practically a year's experience, we found that the tuberculosis people were paying 65 per cent. of the expenses and getting six per cent. of the service. Now we have changed that program and changed it this way. You may call it a generalized program if you like, or a specialized program.

We have one nurse who does specialized tuberculosis nursing. She is responsible for the tuberculosis work in her community. She attends the clinics, helps with the baby clinics and makes the contact in the homes. If she has certain groups of tuberculosis cases in a district that can't be reached and it is necessary to see them within the next few days, or a week or ten days, the nurse who does the generalized nursing in that community will go and see how the people are doing. We are getting service now and getting good dispensary treatment, much better than we had before.

We have another community which has a generalized service work, a specialized service and the board of health nursing service. At the present time we have eleven nurses doing generalized work and seven doing specialized tuberculosis work. We have twelve nurses with the board of health. The nurses who are doing school work turn in a few cases of tuberculosis but only a very few. In Atlanta our specialized tuberculosis work stands second to none in the United States. Here we get all phases of the work. This is specialized tuberculosis work. We do not forget the family is the unit. If there is one case of tuberculosis in the family the whole family is brought to the clinic for examination. If a case of pellagra is found it is transferred to the department specializing in pellagra cases, if dental care is needed the patient goes to the dental department, if throat needs treatment, he is sent to the eye, ear, nose and throat department. Sometimes we find the case is

venereal instead of tuberculous. A special effort is made to detect all venereal diseases. A Wassermann is made of almost every patient that comes to the clinic if there is a question of doubt, and if necessary he is treated. In this way all cases are carefully cleared up. If syphilis or tuberculosis, pellagra or tuberculosis, he is treated accordingly. We find that tuberculosis and syphilis frequently go pretty close together. We have received valuable information and help in this method of clinic care.

The problem is not always a question of sanatorium treatment but a question of the family. We consider the social problem as well as the medical problem. If we find, after taking one or two members from the family who are suffering from tuberculosis that there are no more cases in the family, and all is entirely cleared up, we simply have the members of that family come back periodically for examination or until such time as we feel they are safe.

In the city of Atlanta, we have one of the largest mill districts you will find anywhere in the state. There are a number of cotton mills. Fortunately or unfortunately all but one mill comes within the city limits so that the majority of the people live within the city limits. We can't do specialized nursing in the industries as we do in other communities. These nurses get but little good tuberculosis work done, not because the superintendent of the work is not interested in tuberculosis but, frankly, she never had any special tuberculosis training, consequently I don't know how we are going to handle it.

We have had two nurses who were doing specialized tuberculosis nursing. They worked for a while but they were not specially trained tuberculosis nurses, even though they came with the best sort of credentials for public health nursing; they were graduates of splendid schools, but had no experience in the field and no experience in making contact with the homes, and consequently they failed.

I want to say that I don't see any way that we will have specialized and well done work in tuberculosis unless the superintendent of the group on the specialized staff has had expert tuberculosis work or experience in the actual field, contact in the home. If there is any place where I could get a nurse who has had special tuberculosis experience, either at work on a staff or in one of the schools of training I should be glad to have her. I would place her at the head of one of these staffs and trust her every time. Unless we have this, we won't get the results.

Miss Bertha H. Gibbons, Buffalo: We have nine field nurses and we have a staff in the District Nurses' Association of about forty-five. When we can not get to the bed-work, we turn that over to the district nurses. While the district nurse is engaged in that home, our nurse stays out. We feel that the district nurse is sufficient, and just as soon as that case is closed, she is ready to turn it back to us and our nurse again takes charge. In the Health Department we have twenty-two school nurses and out of those twenty-two school nurses, six have been graduated into the tuberculosis division and we feel that these nurses

understand tuberculosis work sufficiently to turn over to us any children showing symptoms. I think they are always on the alert. We carry about eighteen hundred cases and each nurse has about two hundred, which is too many by far, but we have all the nurses we can afford.

The Chairman: I shall ask Miss Marshall to close this discussion.

Miss Mary E. Marshall, New York City: I am sure we have all been much interested in what has been said. The experience that has accumulated has been very valuable experience and has been very varied, covering as it does, all the United States. In this country you can find somewhere, practically every kind of generalized and specialized work. I am inclined to think that the tendency is probably towards generalized work because whether we are doing tuberculosis nursing, child welfare nursing or generalized nursing, we are gradually coming to see that we are all *public health* nurses. In order to be a good public health nurse, we have to know and practice the essentials of all the specialized types of work and I think our experience is gradually going to push us into that kind of work.

As the last speaker said, when a nurse in a city has to take care of two hundred positive cases and give bed-side care as well as all the preventive work, it's easy to see what will happen to tuberculosis nursing.

I think the great responsibility rests upon us as tuberculosis nurses and public health nurses to educate all of the people as to what the duties of a public health nurse really are. Of course, it is very much easier to make an appeal to the public on a specialized line. They understand tuberculosis nursing much more easily than they can comprehend *public health* nursing. We must gradually, but just as fast as we can, make the community understand what we mean by public health nursing or what we ought to mean by that phrase. We must teach them to know that it means family work and family work will include every one of the specialties.

A nurse who has been at the head of an experiment in generalized public health nursing in a city of about 170,000 told me just recently that she had been convinced from the experiences of her staff during the last year, that since her nurses had had a tuberculosis education they were finding many more tuberculosis cases in the families to which they were called for some other purpose than among the contacts of their positive cases of tuberculosis. That is what we are all going to find when we get into the practice of well rounded out public health nursing and we are not going to achieve this until every nurse gets acquainted with tuberculosis.

I think that this is an opportune time to make an announcement in which I am sure you will all be very much interested. The Executive Committee of the National League of Nursing Education passed a resolution in January and reaffirmed it at the annual meeting in Kansas City. It recommended that every accredited school for nursing shall give its pupils both theoretical and practical work in tuberculosis nursing. A committee was also appointed to frame standards and to formulate

outlines for that purpose. The tentative outlines have just been completed and are now being submitted to various experts and later will be published. When every training school gives its student nurses two months of practical work among all types of tuberculosis cases and also a series of lectures and demonstrations, then I believe it is going to be very much easier to get results in tuberculosis work from a generalized service.

Even in the generalized service, where it has been tried out for a number of years, it has been found that we are going to need "specialized consultants." Miss Crandall used that term first and I think it is a very good one. I think it will help to make clear in our minds just what the management of the generalized service should be. A physician can not be equally well informed upon all types of disease. He calls in a specialist when he suspects a case of some specific disease and they have a consultation. I believe that with our generalized program we shall have staff nurses doing generalized work and nurses with special training and experience in tuberculosis work, child welfare and other types of work, whose business it will be to act as expert consultants, to help the generalized nurse with her special problems.

DETECTION AND CONTROL OF CONTACT AND ARRESTED TUBERCULOUS CASES

By Edith M. Blades, R.N.

Framingham, Mass.

The work of the nurse in the Community Health and Tuberculosis Demonstration research is unique in that the active tuberculosis cases are not the principal part of our study. When active tuberculosis cases are discovered, they are under the care of their own physicians and are, if necessary, supervised by the regular town health authorities, being visited by the nurse in charge of the town's tuberculosis patients. The large group comprising over 100 apparently arrested cases of tuberculosis, however, many of whom have never known they have had the disease, are among those which the Demonstration nurse covers in her daily work. Most of the cases in this apparently arrested group have been discovered during the Demonstration, either in the examination drives, through the industrial clinics, or by the consultation service. Many of these cases have never been reported to the town or state department of health as tuberculous in view of the fact that they were apparently arrested at the time of discovery.

It is, therefore, with a great deal of difficulty that this group of arrested cases is followed and the contact is often of the most casual character. To gain the confidence of these people and try to point out to them that, although they are not actively tuberculous, they have probably had this disease and need to be careful lest they break down again, and even to follow them in their daily life, requires a great deal of time and diversified method of approach. It is only by being constantly associated with the people of the community and gaining their confidence that an observation on this "apparently arrested" group can be obtained. This is a very essential part of the Demonstration work inasmuch as we are very desirous to discover whether they remain well or break down, and if they do, what the cause of activation is. Up to the present time there have been ten cases that were arrested at one time and yet during the Demonstration period have become active again. In a few of the cases very little information of any kind can be obtained, either from the patients themselves, their relative, or neighbors. This small number represents about the same percentage as the percentage of incorrigibles found in any active group, which number is never large at any time. The work of the nurse in this follow-up of arrested cases can also be put to advantage in the discovery of new cases, because when

confidence is gained it frequently occurs that people ill with obscure lung disease who have not called a physician can be urged to seek medical advice. The Demonstration in its work has been fortunate in that the nursing service is also associated directly with some of the town's social and charitable organizations. The nurse as investigator for the Associated Charities has special opportunities for coming in contact with some of the arrested cases and with possible suspected tuberculous cases. Also, the nurse as one of the committee of the Red Cross has been able to utilize this type of contact in the tuberculosis research.

In the tuberculosis work of the town, the board of health nurse visits all of the active cases that are reported, but any cases that for one reason or another have not been reported by their own physicians are frequently visited by the Health Demonstration nurse until such time as they are placed under the health authorities. The coöperative exchange of assistance in this respect is carried out, although there is no centralized bureau of nursing service. Very little of the work can be said to be overlapping.

It is absolutely essential in work of this kind, which is so intangible, that the nurse should be constantly going in and out among the town's people. We have found that our Children's Health Camp is a fruitful source for many contacts. The nurse doing the research work among the arrested cases also supervises the Health Camp. In investigating the environment of under-nourished children for the camp and then subsequently following them, many new contacts are made. The visits to the homes of the camp children furnish an excuse for frequent visits and for inquiring into the health of all the members of the family. The children that are members of the camp and their families are extremely grateful, and in most instances willing to coöperate in every way to further the work. Cases of tuberculosis have been so discovered and the under-nourished children, that might possibly be tuberculous, can be kept under observation and studied by the physician at the Demonstration during the school year. Along this same line the nurse can frequently assist the mother in families of camp children by giving assistance in arranging her budget, so that suitable food can be given to the children admitted to the camp. In this connection, the nurse is aided by the domestic science students of the Framingham State Normal School. These students go into the homes of families selected by the nurse and instruct in the preparation of food, etc. Especially is this service helpful to the Italians, as the children who go to our schools desire to have American food, and in many instances the mother is familiar with the preparation of Italian foods only.

The children coming to the camp, who are found to need operations on their throat or nose, are given help to see that they get to the proper hospital or clinic for such operation. These specially conducted parties are most efficient in getting the operation really accomplished. Even though the special aim of the Demonstration is to discover tuberculosis, the nurse is frequently called upon by physicians or social agencies to

look out for children who need hospital care and attention in Boston, and oftentimes the children are conducted from our town to the Boston hospitals by the Demonstration's nurse. This is still another method of establishing contact between the physicians and the Demonstration, and also serves as a reason for the visitation of families by the nurse at later times.

During the Demonstration period several pieces of medical work have been undertaken, namely, the von Pirquet survey when 600 children were tested; the influenza follow-up group, which have been followed three successive times, etc. Since the von Pirquet survey in 1917, three follow-ups of all the positive reactors in this group have been undertaken. This has brought the nurse into yearly contact with children who had positively reacted, and has added materially to the number of visits and observations which the nurse has made annually. Incidentally, it might be stated here that out of all the 33 per cent. of children who reacted positively to the von Pirquet test, there has not been a single one of them that has, up to date, been found to be actively tuberculous.

Three to six months, immediately after the influenza epidemics of 1918-19, 700 people who had had influenza were examined medically by our medical staff. Out of this number those who were found to have broncho-pulmonary signs or cardiac signs have been followed by the nurse three successive times, to see if they were ill or had been ill between the examination period and the yearly follow-up. This has given also another large series of contacts which in some instances have been fruitful in the discovery of new tuberculosis cases and at the same time have kept the nurse in contact with this most interesting group whom many have expected to develop much active tuberculosis. Constantly going over the ground with these very different groups that the nurse keeps under constant observation makes a most important contribution to our research work, and from among this large group of persons visited an occasional early case of tuberculosis is found. And always the friendly or professional call on all these people is supplemented by inquiry into the health of the neighborhood and the nurse is often put on the track of a neighbor who has a persistent cough.

It has been the work of the Demonstration to further all forms of health work and during the past three years exhibits and posters have been in the windows, and in the Demonstration rooms health material, including all kinds of attractive posters and leaflets and pamphlets of all kinds, are on the tables and walls. This gives the nurse an opportunity to furnish some family or families with the health literature that seems to her to be desired by the visitor and in this way constantly adds to the list of people on whom she may call or who will again call on her. We believe that a single friend so made will many times multiply and produce many other contacts which may finally lead to the discovery of a case of tuberculosis.

In a demonstration of this kind we feel that it is absolutely necessary to have several of the staff members long time residents of the town where

the demonstration is to be carried out, because they carry with them the knowledge of the townspeople and the special problems that are presented in that particular community. From the study of the deaths of tuberculosis during the past ten years and where it at present is known, the nurse has always this detailed information and seeks in every way possible to find out directly or indirectly regarding the health of the members of the families.

In her daily routine, neighborhood information often plays an important part, and while it cannot be always depended upon, bits of gossip occasionally lead the way to important tuberculosis discoveries. An entirely secret and confidential list is kept by the nurse of people who "gossip" states are "lung cases" or have chronic coughs, but who have never been reported and as far as known have never been under medical care. Some of these hear-say cases, falling sick finally, call a physician and are definitely recognized and so added to the list of advanced cases or to those which are "officially" reported at death. The nurse is always devising means to get this group of possibly tuberculous persons to seek medical advice with the hope that some definite diagnosis may be made, and in case tuberculosis is diagnosed that the patient will come into the group of those who are under regular supervision.

To recapitulate, in reaching these groups of "twilight zone" possibly pre-tuberculous or potentially tuberculous individuals, various channels have been employed:

1. The medical examination drives — which determined that in a normal cross-section of the community approximately one per cent. of the population if examined would be placed in the arrested tuberculous group.

2. The consultation service carried out in coöperation with the local physicians.

3. The medical work among infants, in schools, in factory clinics, etc.

4. The practical department of health nursing among active tuberculous cases, and the examination of the families in which active tuberculosis exists.

5. The examination of all families showing a history of tuberculosis during the ten years preceding the Demonstration.

6. The frequent follow-up of children under special summer camp supervision or in nutrition class work.

7. The re-examination of those individuals who suffered from influenza.

8. Follow-up work on the large group of children discovered in the first examination drives and subsequently, in school or camp work, who showed evidences of cervical adenitis.

9. The follow-up of children who in the first year of the Demonstration gave a positive reaction in the von Pirquet survey.

10. Other contacts with families established in relief work, Red Cross visiting, etc.

11. Certain casual intangible relationships, possible to a nurse well acquainted with the community and its people, whereby the genuine "leads" in the mass of gossip about the physical well being of individuals

or families may be traced down to possible cases needing modified observation, at least.

In this reservoir of arrested or potentially tuberculous individuals, there are, of course, many that never have been reported to the department of health, that have never themselves admitted the presence of tuberculosis, that are difficult to follow therefore, and that can be observed only by an indirect and relatively ineffective form of contact.

The Demonstration believes that these contact or suspicious cases should be followed in routine practice for a year or perhaps two years, at least. Of course in Framingham, for research and investigative purposes, these groups are being closely observed through the entire period of the Demonstration. Cases that do not have a definite history of tuberculosis, but that are for one reason or another considered potentially tuberculous, should be visited during the period of modified observation every one to three months, depending upon the history of the case, its associations, its habits, its occupation, the findings of the last examination, etc. Frequently, as indicated above, it is impossible to examine many of these individuals. On the other hand, when they cannot be persuaded to come to a dispensary or health station, they sometimes can be examined in factory clinics through the medical machinery of the factory organization where those facilities exist.

It seems preferable to keep these cases that do not have a reasonably definite past history of tuberculosis out of the regular routine files and records of the clinic. In Framingham these border line groups are of several types.

If a thorough job is to be done, as regards case finding, education, prevention, and treatment, it seems necessary to have in our communities adequate machinery to cover the suspect groups, to follow-up even remote contacts in a modified way at least, and to make the most of all of the social factors that may contribute to the community's ultimate control over the disease.

The Chairman: We are very much indebted to Miss Blades for this paper, and to Dr. Stone for presenting it to us in her absence.

DISCUSSION ON PAPER BY MISS BLADES

Miss Mary E. Edgecomb, Providence: May I ask Dr. Stone how long in his opinion contact cases should be followed? Should a contact be admitted as a case and how classified and how often examined if there are no symptoms?

Dr. A. K. Stone, Framingham, Mass.: The whole question depends on whether the case of tuberculosis is to be considered as a serious one. Dr. John B. Hawes brought this very question up before the Society of the Health Officials of Massachusetts, and it was discussed at length. In general terms, it may be stated that a person should cease to be a board of health case when he no longer has bacilli in his sputum. But this does not mean that such a case should cease to have medical attention although

he may not need to be under the surveillance of the public health officials. The nurses should make such cases feel that they should have examinations frequently enough to make sure that they are not going down hill.

As to the part of your question concerning the number of times the examinations should be made the first year after discharge from the sanatorium, I do not believe anyone can answer that question definitely. There is no law but it is one of the things that have been decided from the observation of the particular case. If a patient does not gain in strength and is not making progress during the first year, then you should insist on frequent examinations and calls on the physician for advice. If the patient is husky and feeling well, the examinations can be made every three months, or in some cases once a year.

Miss Sarah A. Carroll, New Haven: I would like to ask Dr. Stone how long a contact family should be kept under care or supervision, if after frequent examinations none of the members of the family develop tuberculosis?

Dr. Stone: In this question I again feel that no one can lay down an absolutely definite law. This is one of the things we have been trying to do in Framingham. As Miss Blades said in her paper, we have been trying to solve these very problems. Ten people who were supposedly arrested cases of tuberculosis were found to have broken down during the four years that the Demonstration has been in progress. But this is not enough to establish a definite percentage. I would gladly answer your questions if the information were available. If anyone else has this information and will send it to us, we shall gladly welcome it, but it is a fact that no one has this information today. Therefore, it is one of the things that Framingham will try to contribute to the general knowledge. It is hoped that this may be successfully accomplished as a large mass of the community is kept under observation year after year. Miss Blades began with the people who for ten years before the Demonstration were known to be in contact with tuberculous cases. The material is not ready for publication. Miss Blades was simply trying in this paper to show what she is doing and how she is going about to accomplish her aim.

ROUND TABLE: MINIMUM STANDARDS OF REQUIREMENTS FOR NURSES IN MUNICIPAL TUBERCULOSIS WORK

Miss Bernice W. Billings, R.N., *Chairman*

The Chairman: To-day tuberculosis is a definite problem, although there are nurses and social workers who believe this disease is already relegated to the past, and who maintain that if children are cared for and the general health of the community is built up, tuberculosis will take care of itself. Although these preventive measures are exceedingly valuable, the time has not yet come when we can overlook the man or woman with active or inactive tuberculosis. The known cases of consumption must be cared for, and we must use every measure to locate the unknown cases by means of a better system of follow-up work, additional clinics, general education and publicity.

Public health nurses engaged in municipal tuberculosis work are in the most strategic position to make the direct attack on the tuberculosis problem. In the past when nurses were appointed to city positions, little or no care was exercised in their selection, as comparatively few nurses knew tuberculosis work intimately, or had received any training in public health nursing. To-day much of this is changed. Many of the nurses in follow-up work have already received training in public health nursing or have acquired a certain amount of experience in the work. The nurses who are engaged in this type of work should have received a good foundation of education and training, and should also have a general background of information on all branches of public health nursing. This should be coupled with a point of view which enables the nurse to see not only the sick person, but the entire family. In addition to this training and experience, the nurse must have good health, a good disposition, and a spirit of optimism, if her efforts are to meet with success.

As many of the nurses now engaged in active tuberculosis nursing will become the supervisors and executive secretaries of tuberculosis associations, it is imperative that they should have received at least a high school education or its equivalent and a training in a school for nurses connected with a good general hospital. They should be registered nurses and should have received instruction in a school for public health nursing, either while in training or after graduation, or should possess the equivalent of this course in experience.

With a large staff of tuberculosis nurses, and the ever constant changes,

these requirements cannot always be met, but we should insist that nurses employed as tuberculosis nurses should have received at least two years of high school training or the equivalent; should be graduates from an accredited school for nurses; should be registered, and should have had at least a four months' course in public health nursing, or a sufficient amount of experience to serve as an equivalent to this course.

The curriculum of every school for public health nursing should include tuberculosis nursing and clinic work.

Everyone interested in public health nursing will welcome the day when the general hospitals are provided with wards where tuberculous patients may be sent for diagnosis, and cared for as long as necessary. This would be a helpful factor in the education of all nurses in training schools.

If affiliations could be made between general hospitals and tuberculosis institutions, it would assist in broadening the education of the pupil nurse and would build up a higher standard of nursing in the tuberculosis sanatoria and hospitals.

Supervising tuberculosis nurses have grave responsibilities toward the nurses under their direction as well as toward the patients. Nurses doing the follow-up work are visiting patients who face long illnesses, and more often than not, a lack of money. Both the patients and their families are frequently discouraged and the nurse is usually the only person who visits the home regularly bringing cheer and hope. She must be ready with both if she is to be of assistance. There are nurses who have had little background in education previous to taking up training, and who after graduation have not had an opportunity to take a course in public health nursing. These women may possess the ability not only to teach the tuberculous patients how to follow instructions, but to inspire them to do this day by day. In such cases would it not be possible for the supervisor to make provision for additional education?

There are many nurses who have entered tuberculosis nursing and brought to it good training, but who after a few years have lost interest in it, and are thus unable to contribute the enthusiasm which is so necessary. There should be some way by which supervisors could transfer from one section of the city to another, or from one department to another, these nurses who have become discouraged. Six months or a year of child welfare or school nursing would act as a tonic and stimulus to the woman who has carried on tuberculosis nursing for two or three years, and has grown tired under the stress and discouragement of it. These transfers would help the nurse and would be a benefit to that portion of the city in which she worked. Likewise there should be opportunities for nurses on the staffs to attend lectures on tuberculosis and general public health. Plans should be made to have them visit sanatoria, hospitals and clinics which are conducted by other organizations in the city or state. By this means these nurses would receive that same stimulus and interest which brings us to meetings such as this of the National Tuberculosis Association.

The public health nurses doing municipal tuberculosis work are in the front line trenches in this great warfare. They should know local needs much better than anyone else. These nurses can help in this campaign by bringing their suggestions to the local tuberculosis associations by means of informal conferences. It would be a stimulus to both agencies and would develop a spirit of friendliness and coöperation which does not always exist between the official and unofficial agencies to-day.

By urging high standards of education for all public health nurses and by insisting upon subsequent educational advantages for these nurses after they are employed in tuberculosis nursing positions, we shall develop a group of nurses who will look upon tuberculosis nursing in its broadest aspect. These are the women who will be our future leaders in this movement. Let us make every effort to help them.

DISCUSSION

Miss Mathilde Kuhlman, New York, in endorsing the remarks of Miss Billings, made the suggestion that the tuberculosis nurse should have from three to six months' experience in a well managed tuberculosis sanatorium in order to be able to apply sanatorium methods in home treatment.

Miss Zepha M. Gardner, Boston, urged that opportunities be given staff nurses to take courses in social service work and that staff nurses be required to sit in conferences in their respective districts with the different relief-giving agencies.

Miss Mary E. Edgecomb, Providence, emphasized the need of lectures on tuberculosis before all pupil nurses.

Miss Elizabeth Gregg, New York, said that in New York City, nurses are selected from an eligible list promulgated by the Civil Service Commission and serve a probation period of three months. Aversion to tuberculosis work is due to lack of knowledge of the interesting field of work and will pass as soon as nurses are educated to see its many possibilities. The nurse should do her own social work; turning over her case to someone else robs the work of all its interest. The future nurse will be better trained to handle her own social problems and a liking for tuberculosis work will follow. The minimum requirement of field work is the ability to get the family to put her instructions into practice.

Miss Chetwood, Hackensack, N. J., spoke of the effort which is being made in New Jersey to secure affiliation between the accredited schools of nursing and the tuberculosis hospitals.

Miss Nora Spencer Hamner, Richmond, Va., reported that the Richmond School of Social Work and Public Health has arranged with all hospital training schools in Richmond to enroll senior student nurses in the tuberculosis class, the Richmond Tuberculosis Association having made an appropriation to cover the cost of the course.

Miss Mary Carter Nelson of Binghamton, N. Y., reviewed the development of tuberculosis nursing in New York City from its incipiency in

1904, and also traced the steps which, starting with the appointment of a tuberculosis committee of the National Organization for Public Health Nursing, led to the formation in 1918 of this nursing section in the program of the annual meeting of the National Tuberculosis Association. In May, 1917, at a meeting of the three nursing associations, one of the principles laid down was that there should be a course in tuberculosis nursing in every nurses' training school. The following year this nursing section was formed with the aim of making the standards of tuberculosis nursing as high as possible. The resolution of the American Medical Association that general hospitals establish tuberculosis wards was mentioned. This means that there is hope that a course in tuberculosis training may soon be included in general hospital training courses.

After some further discussion a motion was made by Miss Nelson that anyone having suggestions which might be of value to other nurses in tuberculosis work report them to Miss Marshall of the National Tuberculosis Association to be passed on through the Journal of the Outdoor Life or Bulletin and that Miss Marshall endeavor to establish a public health nursing section in the Bulletin.

Miss Marshall in closing, urged that Miss Nelson's suggestion be carried out. Tuberculosis work is changing and a flexible standard is needed. Nurses in the field are in a position to watch the application of new methods and any reports of the success or failure of these methods will be of value to others.

It was voted that a committee of five be appointed by the Chairman to make a study of the minimum requirements and standards to be presented at the annual conference in Seattle.

Joint Meeting of Sociological and Nursing Sections

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DES MOINES, IOWA

MALNUTRITION AND TUBERCULOSIS*

By W. R. P. Emerson, M.D.

Boston

I should have preferred to have an underweight child, a so-called pre-tubercular child — whatever that means — here in person to illustrate what I have to say. However, I shall depend chiefly on slides and some charts to show the points that I would like to bring out.

The greater part of work in tuberculosis thus far has been to prevent contagion, and take care of those who already have acute tubercular processes. There is, however, another field of prevention, and that is to increase the resistance of the child. The younger the child, the less his resistance to tuberculosis; and so in the early years a great amount of infection takes place in children, so that we can safely say that at the age of eighteen most children have become infected with tubercle bacilli causing inflammatory processes which have become walled off, and are waiting for a chance to develop. When that opportunity comes in stress of overfatigue, overexertion or from the lowering of resistance that occurs from measles and acute diseases, then we have what we call acute tuberculosis developing, dating back, however, to an early infection.

So then, our point of attack, it seems to me, should be to do away with the malnutrition that exists among children. About a third of all the children of both school and pre-school age, are under weight for their height; are undernourished and malnourished.

Now, I want you to understand a little more about what malnutrition means, and I can perhaps show you better by slides than in any other way. These slides are made from children we have been studying all over the country in different cities — New York, Chicago, Boston, Rochester, and various places where we are conducting nutrition centers.

These slides illustrate work that we began in Boston twelve years ago, trying to get undernourished children up to normal. I found this group coming to the hospital with no diagnosis; sometimes they were called pre-tubercular, sometimes general debility. I took a group of ten or twelve, having them come each Saturday morning, and decided I would know what happened to them day and night. I tried to get them well; up to normal. Only occasionally was I able to accomplish this. It took three or four years before I could get many of them up to weight, and that was because I didn't understand the essential cause.

* Lantern slides were shown in connection with the paper.

So these slides illustrate a part of the story of finding the causes of malnutrition.

Slide — Here is the type. This boy is nine years old, and has the body weight of a boy of six. He has a flat chest, round shoulders, rather prominent abdomen, a slight bend in the knees and he has the posture of fatigue. His body weight does not sustain his height, and although that posture is considered generally of no significance, I want to explain, if I may, the significance of it, the very great seriousness of it.

With this boy it took me two years and a half to find out what was the matter. The fact that he stands in that position, that he has that posture of fatigue, is in itself of the greatest significance. The boy is not growing right, and there is some fundamental reason. I will show you the reason in this case.

Slide — Only two months ago, I found by means of x-ray pictures, taken repeatedly, a slight deformity of the duodenum, and on the basis of the weight charts, and the fact that we had not been able to get the boy to gain, we had an abdominal exploratory operation and found congenital bands causing obstruction in the duodenum. Since that time the boy has gained half a year's growth in four weeks. Such was the diagnosis.

Slide — Here is another boy whose regular features make him look well when dressed, but you see the same posture — flat chest and round shoulders.

Slide — Here are two boys. One is three, and weighs twenty-nine pounds; his brother is eight, and weighs thirty-three pounds. There is a difference of four pounds for five years. One boy is happy in his disposition, but the other is quite unhappy, particularly in his likes and dislikes, and is very difficult to manage — so difficult that his mother wanted us to continue our nutrition class in the summer because it helped her manage her boy.

Slide — This shows a group of Chicago boys waiting for working certificates — the same undernourished group, showing the posture of fatigue, although some of them are standing up in order to look right.

Slide — Here are six little girls as they sat in line on the settee at Massachusetts General Hospital, taking them as they happened to be sitting. Their faces show their malnutrition. You see their serious expression, lines under their eyes, thin arms, flabby muscles. The face alone shows that they are in an abnormal condition.

Slide — A side view of these girls shows in every case that same fatigue posture.

Slide — Here are two school girls from Chicago. I want you to notice the deformity, the awkwardness and awful deformity of these children, their protruding shoulder blades and round shoulders. Twenty per cent. of this group (I am speaking of a third of all our children) have spinal curvature. One child in three is physically unfit for starting life, and is handicapped.

Slide — Here is a picture of two white rats from the same litter. This

rat was kept undernourished during his growing period. Later he was fattened up and became the size of the other rat. Then his vital organs were examined to see if in recovering weight his vital organs also recovered, and it was found by Stewart and Jackson of Minneapolis, who made the study, that they did not recover.

Slide — The stunting that occurs in the bony structures may explain the difficulty in child-birth in women, having the development retarded during the growing period. Here are two white rats — not the ones I showed you, but one malnourished during the growing period. These are from MacCollum's laboratory showing the round shoulders in the white rat. Here is the normal rat, with the straight spine, and here is the white rat with round shoulders. We can't say he has them because he didn't sit up straight, or because he wore a belt instead of suspenders. It has to do with his malnutrition, and you can see the contraction of the chest, and deformity that comes with malnutrition.

Slide — This picture shows the ptosis that occurs in these cases; which we find with the x-ray is the same as that occurring in children. You see the narrowing of the chest, and here the cross-section of a well rat, with the good chest space. The other shows so much contraction of the chest that it divides the cavity almost into two parts; one for the heart and one for the lungs.

In looking at the wreckage that occurs you might pity the white rat and ask, "Well, why couldn't that white rat have some of our human intelligence applied to him. If he had been told to drink four glasses of water a day he might possibly have been all right." We might say, "Mr. Rat, if you had kept your stomach in and chest out, perhaps you'd be all right, or if you had been sick enough to have had one lung already infected, and the other beginning to show infection then you would have had a careful physical examination."

Then when we have found a "spot" or something, we would send him to a fine sanatorium where he could have every care. But not being sick, you see, he wouldn't get the examination. After all, there might be nothing lost, because if his great-grandfather on his mother's side was undernourished, why, of course we'd expect this rat to be undernourished too.

Slide — Here is one of the early charts of one of the children that I tried to get to gain. If you think it is easy to get these children well, just try it. No doctor after trying it can say that it is an easy medical thing to do. This boy was in the class; came with his mother, and did not miss more than two weeks out of twenty, and still he hardly gained a pound — getting farther away from his normal weight line than when he started.

I have another chart of the same boy. The work was continued through forty weeks, and I was not able to get him well because I didn't know at that time what was the matter. I thought children were underweight because of poverty. We found this is not so. Less than four per cent. of malnutrition is due essentially to that cause. I thought

it was due to tuberculosis. We find that is not true. I didn't know what it might be due to, unless it was syphilis, but we do not find a large percentage of this disease among these undernourished children. The real diagnosis in this case was overfatigue and at that time I did not recognize that as a primary cause of malnutrition.

Slide — Now, in order to get this large group of children well we must find the causes of their malnutrition. Just as in the hospital wards, in order to treat sick patients intelligently, we must find the cause of sickness, whether malaria, typhoid, or pneumonia, so in the undernourished group we have to find a cause of the malnutrition, and there is a cause every time that can be found by giving a child a complete examination — not only the physical or medical examination, but the physical growth examination; which is a task of finding out the defects that interfere with growth. In some cases we make a mental examination, and in all cases a social examination for anything that has to do with the child's activities and food and health habits. Having made these complete examinations, we find the cause. Then we remove these causes; and the child gets well in a remarkably short period of time.

The five causes of malnutrition, as we have found them, in order of importance, are, 1, Physical defects that interfere with growth, particularly inflammatory processes, such as diseased adenoids and tonsils; 2, lack of home control; 3, overfatigue; 4, improper diet and faulty food habits; and 5, faulty health habits.

Now, you will notice that these causes operate in all classes of society, and this explains why there is often more malnutrition among the well-to-do than among those in poorer circumstances.

Slide — Here is a physical examination form, simply giving the words describing the conditions and particularly the defects that interfere with growth. Children who have physical examinations made according to this form, similar to that of the army or of a life insurance company, show an average of five and one-half defects, some of which interfere with growth and are causes of malnutrition. Every child in this country has a right to the ten or fifteen minutes' time, required to discover his defects, so that they may be known and steps taken to have them removed.

School inspection, valuable as it is, will not discover the causes of malnutrition. A doctor can no more tell the causes of malnutrition if he examines the children with their clothes on, than you can tell what kind of a horse is under a blanket.

Slide — We must know the child's food habits, and the way to find these out is to have him bring in a list of what he actually eats. Here is a little girl's list. You will notice she has no milk or cream with her cereal, and is taking tea. Correcting those two errors in her diet, we increased the amount from 450 calories to 1000 calories. We substituted cocoa for tea, with cream (this was before the War) and those simple changes can be made without upsetting the whole household. If a child has at least a pint of milk a day, stopping tea and coffee, with just the

usual diet in practically all cases, he has a perfectly adequate diet for gain.

Slide — Here is a hundred-calory portion exhibit of food, so simple that the mothers can measure what is taken. An infant has its food measured with great care. We quibble about a quarter of one per cent. protein, or carbohydrate for the infant; but after they are about two years of age children are just fed hit or miss. It is very easy to measure the food because a hundred-calory portion is represented by a banana, ear of corn, large orange, five ounces of milk, a slice of bread, etc.

Slide — We even measure food for a dog. We give him so many dog biscuits a day, but children often eat with both hands and wash their food down besides — they are ambidextrous, you might say, when it comes to eating!

Slide — Now, here are some of what you may call almost foolish diagnoses, but they are of the most grave nature in their results. Here is a mother who thought thin soup was very nourishing, and when the children filled up on thin soup their twenty-four-hour amount was too low for gain. We suggested food of a higher value, and the weight went promptly over the top. Now, the diagnosis in that case was not acromegaly or some other obscure medical diagnosis, but it was thin soup.

Slide — Here is a boy seven years old who didn't gain. I found that he would rather play than eat. He was bolting his meals; taking three to five minutes for a meal. It was a very difficult habit to correct, but he wanted to be a good baseball player, so he was willing to let his mother feed him for a whole week. She couldn't shovel the food into him fast enough to give him indigestion, and he made a good gain. The diagnosis in this case was not some medical disease, but just fast eating.

Slide — A horse is rested before he eats, or else you won't have the horse long. A good horseman won't drive his horse in and let him eat right away, because he looks after him, but children often eat on the run.

Slide — Here is a girl who ate very little breakfast. She got hungry in the middle of the morning, filled up on candy, and spoiled her appetite for the midday meal, and then took more candy in the afternoon. We suggested that she have candy only after meals, and eat a good breakfast. She made a 7¼ pound gain in three weeks.

Slide — Here is a boy that we could get to gain a little at first, but then week after week there was no further advance. He was going to school all day and then having Hebrew lessons for an hour or so at the close. We consulted the Rabbi, saying we felt sure he did not wish religion to interfere with health. So we stopped Hebrew lessons, and the boy started to gain. This diagnosis was overfatigue.

Slide — Here is a girl down in the west end of Boston who did not gain. We found she was sleeping with four other persons in a room with the windows shut tight. She slept with her mother and sisters down under the bed clothes. We got her head out of the bed clothes;

persuaded the mother to open the windows, and then there was gain. Here again the diagnosis was not obscure disease, but bad air.

Slide — Here is a girl in a foster home who gained slowly, then became unhappy and lost. She was transferred to another foster home where circumstances were the same as at the first place, but she was happy and gained rapidly. Human beings, like animals, need contentment and happiness in order to have good nutrition.

Slide — It sometimes happens in tubercular families that one child is taken sick and everything is done for the one, while the other children are neglected and unhappy. A greater disorganization occurs in the homes of the tubercular families than in any other I know of. Here is a gain of eleven pounds in five weeks, showing the value of midmorning and afternoon lunch. This girl gained five pounds a week there, a pound and a half here, and then stopped gaining. She was in an institution where the midmorning and afternoon lunch was stopped. This week the cook had gone on a strike. The child ate more in the three meals than she had been eating in the five smaller meals and yet lost in weight. The lunches were resumed and she went over the top.

Slide — Here is a boy in the same institution, called "pre-tubercular." He was something of a test case. We started him in the class, and he gained the first week and then lost. He was homesick; got over it and gained up to this point, when he lost again. At first we couldn't find out why, but finally discovered that his rest period was disturbed by fooling with another boy. We separated them, and then he gained. He went along slowly to that point, but the fact that he didn't go over the top, as he ought, led us to believe that some questionably infected tonsillar tissue ought to be removed. We had it removed, and didn't know enough to keep him in bed more than one day. Now we keep the children in bed for four or five days with no resulting loss of weight. He lost five pounds, and regained it rapidly, until he went to school, which stopped his gain; but he pegged along to this point, went to a picnic and lost, and then got over that and came to the top. That is the story of that boy reacting to influences quickly. When he got up to this point he had advanced from sixty-eight up to eighty-two pounds. He was perfectly well.

Slide — Here is a girl at Massachusetts General Hospital whom we couldn't get to gain, because she needed an adenoid and tonsil operation. We had it done, and then she went over the top. The effect of the diseased adenoids and tonsils is very marked, and I am sorry to say that in our tubercular group attention is often so focused on tubercular processes that these children are particularly neglected as regards their general examination.

Slide — Here is a composite graph of a group of fifteen children gaining on an average three ounces a week. They were questionable cases of adenoids and tonsils, but on the strength of their failure to gain operations were performed, and beginning at the same point they gained over

a pound a week. I have duplicated that chart exactly with another group.

Slide — Now, having found the cause of the malnutrition the problem is how to remove that cause. We must then control the four forces that safeguard the child's health. Those four forces are (1) *the home;* (2) *medical care;* (3) *the school,* which represents the day's work and (4) *the child's own interest.* Those are the four factors that safeguard his health, and explain, to my mind, why our wholesale crusades, wholesale milk movements, etc., are ineffectual. They may affect one or two sides of the parallelogram, but unless you have control of all sides you cannot make full progress.

Slide — The way we coördinate these forces is by means of a nutrition class. The children come once a week. The ideal place is in the school, because this is health instruction. The child that gains the most we put at the head of the class; the next one next, and so on. The parents come in, representing the home. This mother came in from Wellesly, twenty-four miles from Boston, getting a neighbor to take care of one child while she brought this one in to our nutrition class, carrying another in her arms, never missing a morning and getting up at five o'clock on cold mornings when the thermometer was below zero. I tell you that to explain the interest of the mothers, because the success of the work is based on the love of parents for their children. They come from long distances, from other cities — Lowell, Beverly, etc.

Slide — The teaching value of the class itself is great. This girl had been at the head of the class. She stopped tea and coffee and went to bed at reasonable hours; took rest periods, and made a good gain. But her mother was afraid to have the windows open, and the girl was fond of "banana splits." When she found the other girls gaining she corrected her food habits, her mother opened the windows, and this girl gained as well.

Slide — Here is a group of children who are state minor wards placed in foster homes. I did not think the foster mothers would be interested to come, but here is a group of fifteen children and fifteen foster mothers, and this group gained in their own homes — their foster homes — at the rate of 425 per cent. of normal gain without extra expense.

Slide — Here is another group, of the work of Miss Skilton, comprising six nationalities, including the Back Bay nationality. I don't know whether you are familiar with it or not; the children are ranked in order of their gain, the mothers are present, and here are the charts and nutrition worker. This group gained at the rate of 525 per cent. without any extra expenditure.

Slide — Here is the group, and each one has his own separate problem. This Italian boy is a student, studying all night. This was our boy of the Back Bay nationality, the son of one of our leading surgeons, whose mother wanted him to gain. We suggested this class in the south end of Boston, so she left her limousine round the corner and brought

him in. He was bolting his food, and reading an hour and a half in bed in the morning before breakfast.

This little girl had a great responsibility in her home. She had to boss the whole family, including father and mother, which kept her busy most of the time. We relieved her of that responsibility, and she gained. This girl in June had three pounds to gain, and kept up rest periods, until in the fall we had to diet her for overweight.

Slide — This illustrates how the rest periods are used. A child lies over a pillow for ten minutes or so, throwing the chest out, and then lies over with the pillow in this position. A rest of twenty or thirty minutes properly taken is worth a rest of an hour improperly taken.

Slide — In New York, down on the east side in Public School No. 64 we did not have any place for the children to lie down. There were three thousand children in one building; but the settlement house next door lent us a room, and we had the children lie down on the floor during the twenty-minute rest period in the morning.

Slide — After the children come up to normal we give them a certificate, and point out that in gaining health they get character as well.

Slide — This was the chart from which I first recognized that these children were really stunted. This boy was underweight; had his teeth attended to, and then he gained rapidly to this point. He was afraid to eat, because of some appendicitis he told me he was going to have; but he came up to normal weight, and then we took his height and found he had grown the average rate of growth of a normal boy. Therefore he had to gain about four pounds extra to get up to normal for his height at that time. We found in the majority of the children when we brought the weight up to average the height had come up, so they had to gain these extra pounds. They were not only underweight, but underheight; that is, stunted.

Slide — Every child who is 7 per cent. underweight for his height is retarded in his growth at least one year. This mother brought this boy in. Miss Skilton said, "Be sure to have him here next week." The mother said, "I will bring him if he will come." This boy weighed forty pounds. The mother weighed more than forty pounds, but she'd "bring him if he'd come."

He didn't come, so we sent word we'd have his picture taken, and again he didn't come. His mother said he didn't care to have his picture taken, so we went down and got him. That is the problem of lack of home control which we must meet the same as other problems; and the way we do is to go to the father and mother and show them the projecting shoulder blades, and explain that they must insist on the boy's minding. Then the boy gets interested in the chart, so all are on the same program, and in this way the question of home control can be solved.

Slide — Children look well when dressed. The father of these two children died of tuberculosis. When they came into the class, walking up the stairs, one of the nurses said, "What are you doing with those well-nourished children?"

Slide — When you come to examine this boy you see how thin his chest is; you see the same round shoulders; he has a big stomach from malnutrition, and his head is out of proportion to his body.

Slide — This shows malnutrition more. What chance has this frail girl against tuberculosis infection; and what use is it to tell that girl to do seventy chores extra, in addition to school and other work, without finding the cause of her malnutrition.

Slide — Here is a child who was underweight; she had made one hundred sixty-six visits to Massachusetts General Hospital, thirty-six visits had been made to the home, and the diagnosis was poverty. I looked the case up myself. The first question I asked was, "Had she a brother or sister?" She had a sister. I said, "I want to see the poor, malnourished sister," and asked her to bring her in.

Slide — And here she is. If poverty made the first one thin, it made the second one thick.

Slide — We are often told that children are "born that way." Here are twins. The children are nine years old, and this child weighs fourteen pounds more than her sister; she is ahead of her sister two years in growth, but the sister was five and a half at birth, to her four and a half pounds. One girl would take milk and cereal, while the other girl did not.

Slide — Here are brothers. This boy you may call the tubercular type. You see it is just like the white rat. He has round shoulders and fatigue posture, while his brother stands upright. This boy fell when he was a child, which interfered with his growth. We must remove the cause in order to get that boy well.

Slide — Here are two girls in the west end that are of tubercular families. We modified their programs, for one of these children belonged to twelve clubs, and the other to eight clubs. They had club meetings every day, in addition to their school work; and beside that, they were working in the evening, contrary to the Child Labor Law. That fact came out in the class, and the woman rounding the children up for this illegal employment disappeared quickly when she found that one of these girls had admitted she was working in the evening.

Slide — This girl was placed in a nutrition class by the foster mother, bringing her from the Children's Aid Society. We brought her up to normal weight.

Slide — And then she was required to go to school from half past eight in the morning to half past two, without a rest period or recess of more than ten minutes, which did not allow her to get any rest or any chance to get out, except a little for the morning lunch. She lost nine pounds, and we had the job to do all over again. The school is an essential factor in the program, and is a most difficult problem.

Slide — This girl was sent to the Westfield Sanatorium in Massachusetts, because of malnutrition. There were ten in her family. She was sleeping in a room without windows. We got the family transferred to a top suite, but we couldn't get coöperation in the school. She was four grades back in studies, undernourished, working hard in the school, and

in the home as much as possible, to help. Then after the school nurse could not get any adjustment made in the school, she was sentenced to attend summer school in spite of her condition and in spite of medical protest. She broke down at the end of a week and was sent home. This picture was taken the other day. She is now forty per cent. more underweight than she was two years ago. We have not been able to get her well because we cannot get the coöperation of the school. Here is her little brother — malnourished as well.

Slide — Here is a mother who was visited by agents of six institutions in Boston, one after another, and she apparently enjoyed them all, but her children were malnourished. She said for the first time she got definite directions when she brought this child into the class. She brought her up to normal, and then the sister, and then came up to normal herself. Her husband had died of tuberculosis.

Slide — Here is a boy they called the "skeeter" in the east side of New York, because he was so thin. Here is another case diagnosed poverty yet his father owned a store. This boy was undernourished from late hours in the movies, not poverty.

Slide — Two of our workers went up to Labrador last summer and eight workers have gone up to organize eight nutrition stations this summer. Tuberculosis is rampant there, and 50 per cent. of all the children are malnourished. Here are some of the boys Miss Moseley and Miss Fuller had last summer. They were able to get all the children in St. Anthony's to gain at the rate of 301 per cent.

Slide — A certain wealthy man came up to the coast at St. Anthony's in his yacht, having a daughter with him. His wife had died. The daughter came to look at the class. Miss Moseley saw she was extremely thin; and when she had weighed, measured, and further examined her, a diagnosis was made of probable tuberculosis. She made a good gain, as well as the others in the class.

Slide — Here are four children, found undernourished in the war area by Dr. Putnam, who weighed and measured children of the French and Belgian refugees, finding 36 per cent. undernourished. She went to Williamstown, Massachusetts, and found there 33 per cent.; the malnutrition in many instances abroad does not exceed what we find here. These children will not get well on food alone. They must have rest, and other factors, in order for them to make up their retardation of growth.

Slide — Here is a class in Rochester, N. Y., where the Tuberculosis Association inaugurated work while trying to do away with malnutrition in all the children in the schools, both parochial and public. This shows a class of children, with mothers present, the charts, the doctor, the principal of the school, and the director of physical education. In some of those classes we have had the priest come in regularly. It is a community work.

Slide — Here is a boy from Chicago, in one of Mrs. Wood's classes. He came up to normal in summer camp, and returned to his industry. The employer was interested to see that he had a glass of milk in mid-

morning and afternoon, and the boy gained nine or ten pounds after return to work.

Slide — Here are some of the results: A group of thirty girls, physically unfit, waiting for working certificates. They are in a class of Arden Shore Camp, Chicago, and this shows the average gain of those thirty girls. It is 650 per cent. during these weeks that they were in the class.

Slide — This chart shows the rate of gain from dietary standards. It was the best I could find. Mrs. Rose's class in New York gained with emphasis on dietary standards, at the rate of 170 per cent. A Massachusetts class, under Miss Price, gained 125 per cent. — just a little over the normal rate of gain. We have had 525 per cent., and even 800 per cent. and 900 per cent., where the causes are removed. This nutrition problem cannot be adequately attacked by means of a single factor.

Slide — Here is a remarkable gain of a boy in Grand Rapids, who belonged to the type of so-called "born that way" people. He was tall and thin, and thirty pounds underweight. He gained thirty-one pounds, coming up to normal — a remarkable rate of gain of 1240 per cent.

Slide — Here is a nutrition camp. I am going to show you the charts a little later of all these children. The first twenty-seven children in the group showed an average rate of gain of 1400 per cent. for the whole group, at a cost of 35 cents a day for food, and maximum cost of $7.12 per week for overhead.

Slide — Here is a girl, who the school doctor said was all right. Her family doctor gave her a tonic. She came to the clinic and was suspected of tuberculosis. Calcified glands were found but nothing in particular was done. She was really passed as being all right. There was not enough significance paid to those things to have anything done. She showed eight defects, but none were considered as particularly interfering with nutrition. We started her on our program. You see the lines in her face; you see the deformity, the pigeon chest, flatness of muscles, and even her hair shows malnutrition. She was twenty-four pounds underweight.

Slide — She started to follow directions, and gained at home. The mother was taken into the hospital, but this child followed directions right along and gained a half a pound a week. In all she gained twenty-four and a half pounds. When she got to normal weight for height, she had grown so tall that she had to gain more pounds.

Slide — Here is another picture of her. You would hardly know her. When she made the gain she became like any other normal child.

Slide — Here is a boy who had a struggle for his health until he was fourteen years old. He had asthma trouble; and was sent to Egypt for a year. What success he had in getting well he worked out through his own efforts, and more from physical trainers than doctors. He said it was the hardest fight in the world, and he had a few of them, I think.

Slide — Here he is again. It interested me very much that Roosevelt had this struggle for health, and then achieved his wonderful physique and activity.

I want to show you these twenty-seven charts of the nutrition camp. Now, then, if the five causes of malnutrition are these — physical defects, lack of home control, overfatigue, improper diet and food habits, and improper health habits — if the essentials of health, which are air, food enough to grow on, a chance to lie down, and a chance for exercise, are present, and if these causes which you see can be removed, then the children ought to gain. This is accomplished by coördinating the forces — home, medical care, the school and the child's own interest. This last we get easiest of all, because every boy wants to be an athlete and every girl wants to be attractive and athletic. In doing this we rehabilitate the home which is founded on the love of the parent for the child, the greatest thing in the world, and the most permanent.

Medical care ought to be supplied, which in this problem seems to be just now most difficult, and the school must have some modification of its program in order to prevent fatigue from too long hours.

Now, do the children gain? I want to show to you this remarkable group of charts, and I am particularly glad to show them to you because I had nothing to do with them except to suggest the program. They represent a group of twenty-seven children, the first cases admitted to a health camp, a so-called preventorium at Grand Rapids, conducted by Dr. Eugene V. Nesbitt, who is here today. He did the physical examinations and saw that the children were free to gain after physical defects were removed.

The majority of these children were "contact" cases. In five instances the parents were in the hospital with tuberculosis. Dr. Nesbitt had them go in free to gain. Then Miss Enid Bailey, the nutrition worker, ran each child on the basis of the chart. If he was very much underweight, activity would be modified and the program changed in order to have him gain.

The children had the midmorning and afternoon lunches; midmorning and afternoon rest periods and went to school as much as they could without overfatigue. The gain was accomplished at a cost of 35 cents a day for food, and at a maximum cost of $7.12 a week overhead.

All these children — not three or four or ten of them, but the whole twenty-seven gained in weight. Their average was 1400 per cent. of the normal rate of gain. Now, I think that was very remarkable.

Here is a chart I have already shown you on a slide. A boy gained thirty-one pounds in twelve weeks. Here is a family, in which all four made a remarkable rate of gain.

All methods for promoting health should be good; but what is right for the well child may be just the wrong thing for the sick child. In a tuberculosis headquarters I looked up and saw a sign "Walk a Mile." Now who is going to walk a mile? Do you want a patient with a fever walking a mile? Do you want the undernourished children, who are struggling to keep up to standards for well children, to walk a mile, when they ought to be flat on their backs getting a rest period? These wholesale

methods are dangerous and must be safeguarded; and you must treat the individual according to the treatment he needs.

There are health measures for well children which may be all right, and are often helpful, but the undernourished children — these physical wrecks that are truly sick — should be treated on a different basis; and I am very glad to say that your Health Crusade committee has inaugurated steps to have a different set of chores for the undernourished child than those for the child up to standard.

We can never get these children well until we stop so much wholesale business and find the individual causes. I am glad to show you some of the results of the class method or group method in attaining these results.

The Chairman: Dr. Emerson has agreed to answer questions at the close of the discussion, but before we open discussion I will call upon Miss Stringer, who will discuss the practical application of these suggestions to the tuberculosis problem.

Before the discussion of Dr. Emerson's paper, I will call upon Miss Stringer, Executive Secretary of the Association of Tuberculosis Clinics of New York City, who will discuss the practical applications of these suggestions to the tuberculosis program.

PRACTICAL APPLICATIONS FOR THE TUBERCULOSIS PROGRAM

By Lucinda N. Stringer, R.N.

New York

While I appreciate the honor of being asked to take part in this program, I also realize the impossibility of making any contribution to the subject on the same program as Dr. Emerson, the father of this splendid movement, and to whom we owe a lasting debt of gratitude.

I am glad, however, to have an opportunity to speak to you on that phase of the subject which seems to be a burning question at the present moment, and about which there seems to be some difference of opinion. I refer to the nutrition worker and her required training.

There is some truth in the popular propaganda saying, "If we control the child the tuberculosis problem will take care of itself."

The general acceptance of childhood infection as a cause of later tuberculosis has made child welfare, and all that it means in the protection of the child, a definite part of a broad anti-tuberculosis program. It has likewise made a knowledge of tuberculosis essential in the training of the child welfare worker. The program of tuberculosis associations and child welfare must go hand in hand, or they cannot be made to work without serious overlapping and dangerous gaps between.

In order to give the child his best opportunities for health development, nutrition and posture classes of the standardized type should be an integral part of every tuberculosis clinic. I would like to emphasize standardized type, for I find the term "nutrition classes" has become a very hackneyed one.

On visiting the various clinics I usually make a point of inquiring what special activities, if any, are being carried on for the children. In several instances I have been told with a great deal of pride, "We have nutrition and posture classes." And on further investigation I find these merely consist in bringing a group of children together in the afternoon for physical exercises and giving them something to eat before going home.

It is very important, therefore, in establishing such classes that they be organized to conform with the recognized standard. The value of these classes has been fully demonstrated, and to restate it here would be superfluous.

A few weeks ago the Nutrition Council of New York City issued a report of their committee on standards of training for the nutrition worker. The committee agreed that training was essential; the course of

study as outlined covered a period of 1500 hours, 690 of which were devoted to general chemistry, chemistry of nutrition, chemistry of food, food economics, and cookery.

Does this mean that this important activity must be delayed until such time as we have experts trained to carry on the work? Or does it also mean that the hundreds of children who are in immediate need of this care will be denied the benefit, for the simple reason that they happen to live in a community which cannot afford to pay the big salary of an expert, in addition to the salary of a public health nurse?

There is a growing tendency to over-specialize in public health work, and we should appreciate the present need of correlating our activities, for there is much duplication and therefore much waste of effort and unnecessary waste of funds, and an opportunity for taking care of the health of the home family is thus lost.

Malnutrition, as Dr. Emerson has pointed out, means much more than insufficient food. It is a definite departure from health; it has certain definite medical and social causes, and certain after effects. In a majority of cases it is a medical problem; it is, therefore, just as important that the dietician have a special training, as it is for the public health nurse to have a training in nutrition and food value.

The combination of public health nurse, plus 690 hours of general chemistry, chemistry of nutrition, chemistry of food, food economics and cookery, is theoretically desirable, and is not open to discussion. It is an arrangement that will ultimately be necessitated for the sake of economy and efficiency, and I would like to suggest that the nurses of this Association pass a resolution urging the schools and colleges which offer courses for public health nursing to include in the curricula a required course on nutrition and food value, and not make it elective, as was the case when I took my course at Teachers College.

Students do not always elect those courses that are going to be of most value in their future work. I also suggest that the course in dietetics, given to the pupil nurses in our training schools, be broadened to include a course in food value and nutrition, thus making it more interesting and valuable.

In the meantime, what are we going to do? The demand is growing, and we have not sufficient experts trained to meet it. It would seem logical, therefore, to utilize that large personnel of public health nurses already in the field. The public health nurse has advantages that the lay worker lacks. As Dr. Emerson pointed out, home control is of utmost value in order to secure the active coöperation of the parent. It may be that the father of the child has tuberculosis. The moment the nurse gains entrance to the home she immediately begins to find out the needs of each member of the family. Her training has equipped her to be helpful in the situation.

Is there any question as to which worker would procure the most satisfactory coöperation from the mother? There is a large field for the dietician, but she cannot take the place of the public health nurse.

In states and large cities where many such classes are being conducted, it is advisable to secure the services of a supervisor whose duty it would be to organize new classes and supervise those already in existence. This supervisor should unquestionably be a woman of highly perfected training. It is assumed, of course, that the worker works under the supervision and direction of the physician; and the success of the work depends to a great extent upon the personality of the worker. Her personality should be such as to invite the entire confidence of the child and his parents. She should have a definite comprehension of the value and need of her work in order to be successful.

Her success may be measured by results, and judging from the results that we have obtained at the Henry Phipps Institute, where I had the privilege of assisting Dr. Landis in organizing and developing this work, the nurse made an excellent nutrition worker. We sent our nurse to Boston to observe how Dr. Emerson organized and conducted these classes, and we in turn were able to instruct many other nurses who are now conducting successful classes throughout the State of Pennsylvania.

Our nurse did not have a technical knowledge of nutrition, but she was under my supervision, and readily acquired sufficient knowledge to adjust the family budget; to estimate how much was available for food; to know the approximate constituents of the common foods, and how to determine the food value to estimate roughly the number of calories each member of the family was getting; if a child was getting 800, what those were composed of and how to supply the insufficiency.

It is a good investment. I would, therefore, urge the tuberculosis associations throughout the country to establish and maintain, if need be, nutrition and posture classes in the existing tuberculosis clinics, extending the movement into the public schools; for the results obtained would seem to justify the amount of time, energy and money expended.

Now, in all of this splendid and much needed work with the school child, do not let us forget to concentrate much of our effort on the preschool child in order to discover defective nutrition in time to correct it before the child reaches school age. As Voltaire so beautifully expressed it, "to preserve and renew is almost as noble as to create."

The Chairman: It seems to me that Miss Stringer in her final remark definitely put the problem to us: with the suggestion that we, as tuberculosis workers in our clinics, should make a definite and active study of the nutrition work, and not limit it to school children, as the crusade is being limited, but extending the interest also to those of preschool age. The papers by Dr. Emerson and Miss Stringer are now open for discussion.

DISCUSSION ON PAPERS BY DR. EMERSON AND MISS STRINGER

Dr. H. R. M. Landis, Philadelphia: It certainly gives me a great deal of pleasure to be able to comment on this work of Dr. Emerson.

Personally, I was somewhat slow in accepting the idea; it was first brought to my notice some six years ago. Several years afterward, however, having these children constantly brought to my attention, I bethought me of this work, and as soon as it was possible to obtain the funds, we started a class at Phipps Institute.

The interesting part about it is that the class that we started in the fall of 1919 was the means of establishing twenty-five in the city of Philadelphia, and throughout the state there are some twenty-five more; showing that the method can be applied under all sorts of conditions and in all sorts of places.

The one thing I think should be very forcibly emphasized is that it is like all other plans, and all other forms of class work — whether tuberculosis classes, or classes for the treatment of diabetics — it depends for its success almost entirely upon the personnel.

If you survey a number of these classes conducted for delicate children, you will find that some are conducted remarkably well; some only fairly well; and you will find those that have failed completely.

The class depends entirely for its success upon how much you put into it. The doctor has to show a proper amount of enthusiasm, and has to know the problem he has to deal with; and has to remember that each child is a particular problem. They cannot be treated as a uniform group.

The nurse who is in charge also has her part to play. Very often I have seen classes, for instance, in which the nurse was efficient; the doctor not good, and vice versa.

There are some who miss entirely the object of the class or the problems to be dealt with. It is absolutely a medical problem. As Dr. Emerson has shown you, food as the cause of malnutrition is only one of the causes that you have to deal with.

I think it is essential that wherever the classes start there should be rigid adherence to the plan as given, not only because results can then be compared more favorably in different places, but also because I feel that whenever you start modifying and making changes, the first thing you know you get into slipshod methods.

There is no question in my mind that these children whom we now consider undernourished, would, twenty-five years ago, have been considered as having tuberculosis. The truth of the matter is that only a small proportion are actually tuberculous. They are potential possibilities, however.

In closing, I want to state that I think the results obtained have proved the value of this method. The fact that these classes are springing up in various parts of the country is good evidence that it is unquestionably the method to try out.

Now, it is not to be understood that food does not play an important part. It undoubtedly does, but it is to be remembered that the problem is not essentially one of dietetics alone. If these children are treated only along dietetic lines, you will fail in 75 per cent. of the cases, no matter how carefully they are fed as to the amount and quality of the food.

Dr. Alfred F. Hess, New York: We must all, physicians as well as

nurses and welfare workers, feel indebted to Dr. Emerson for the work which he has carried out in the last few years. I don't believe any of us realize how large a rôle faulty nutrition plays in tuberculosis; and, more than that, how much improvement could be effected in this regard under the existing home conditions. Furthermore, we must be thankful to him for his energy in spreading this propaganda throughout the country.

Personally, I have been interested in one phase of this nutritional problem in relation to tuberculosis in connection with the Preventorium for Children at Farmingdale, New Jersey. Some of you may know this institution. It was the first preventorium to be built in the United States, twelve years ago. It is near Lakewood; a distance of about an hour and a half from New York. We take poorly nourished children or pretubercular children for a period of three to six months and maintain them under the favorable conditions that Dr. Emerson has described.

They get good nourishment, fresh air, and rest, and they make gains similar to those that Dr. Emerson has portrayed.

I wish to emphasize one factor that was perhaps not stressed sufficiently by Dr. Emerson, and that is the importance of sunlight — not only fresh air. He mentioned four requisites, as I remember, but sunlight should be included under fresh air or made a fifth requisite.

Now, what Dr. Emerson has been doing is really preventorium work without sending the children away; that is preventorium treatment in the home, and in the city. Although I do not believe it can equal preventorium treatment in the country, it can be readily seen that it has an advantage in that it can be carried on on a much more extensive scale than the country sanatorium treatment.

Our preventorium has cared for about 5000 children since its inception eleven years ago. There has been, I think, only one case of pneumonia, a very interesting fact because the children come oftimes in zero weather, from the tenements directly to the outdoor life of the country.

But I want to take this occasion to tell you that it looks very much as though we may have to close our preventorium. We have not received the coöperation from the city departments, from the Commissioner of Public Welfare, that we think we should have. Our per capita allowance has been reduced and the cost of maintenance has increased. The city formerly allowed us a daily per capita of $1.25. That is what was voted to us by the Board of Estimate and Apportionment. This year, although the board voted us an equal amount it has been reduced to 75 cents by the Commissioner, so that we are running at a loss of $1000 a month; and although we are willing to continue for this summer, it is very evident that this condition cannot prevail for a long period. Unless we get additional funds, or unless the Commissioner changes his attitude, I regret to announce to you — those of you who are interested — that we propose to close the preventorium in the fall, as soon as the schools open again.

But to return to the question of tuberculosis: You all know that besides the nutritional aspect, there is of course the aspect of the tubercle bacillus. Now, at a meeting like this one, it would sound as if the whole

development of tuberculosis depended upon nutrition. On the other hand, I am sure that some other meetings of the Association would have emphasized the fight against the tubercle bacillus.

We must recognize two phases; and what we would like to know, probably all of us, is which is the more important. Now, subjects like this cannot be settled by animal experiments. I take some exception to illustrating these nutritional problems on rats, when Dr. Emerson can so conclusively demonstrate them on children. The nutrition of rats is quite different from that of children, and those very rats, I am sure, which Dr. Emerson pictured on the screen were not nourished with the same dietary as were the children.

It is evident that if you leave out some essential food stuff, some vitamine, some particular salt or element, from the nutrition of the rat, the rat will be undernourished compared to the rat of the same litter which had full nourishment. And that is the case with these rats. They were not nourished on the same diets as the poor children were; so that I think as long as we can bring home the subject by means of such excellent photographs as Dr. Emerson has shown of children, we should not have to resort to experiments or illustrations by means of rats.

But, as I have said, the question is: what proportion of tuberculosis is due to faulty nutrition, and what proportion is due to the invasion of the tubercle bacilli. I do not believe that this can be put in any mathematical ratio. It differs from time to time. For instance, in one district there may be one class of the population in which faulty nutrition may be the main factor; while in another district it may be exposure to tubercle bacilli. This may vary at different times in the same country.

You all know that one of the great lessons that was taught us as a result of the war was the increase of tuberculosis in the countries of Central Europe; more particularly in the larger cities, such as Berlin, and especially in Vienna. Now, it is evident that there were not more tubercle bacilli in these cities, and that the tubercle bacilli did not have any enhanced virulence; and that therefore the increased morbidity and mortality was due to the faulty nutrition.

So that if we compared the relative importance of the invasion of the tubercle bacilli and nutrition during the war, and before the war, in Vienna, the results would be quite different. During the war the faulty nutrition in Vienna was of paramount importance, and led to a high mortality; whereas before the war it may have been of secondary importance in relation to the tubercle bacilli.

I merely wish to point out the fact that although we are stressing the question of nutrition this morning, we must also remember that it is only half the question, and that in conjunction with these efforts to nourish the children we have to remember at all times that we must surround them with such conditions that they will not be exposed to infection by tubercle bacilli.

Dr. Philip King Brown, San Francisco: There are a few practical sides to this question as they concern tuberculosis infection and disease

in children of which I wish to speak, because I hope Dr. Emerson will offer his views about these things — things that are excessively important to our dealing with this problem.

First of all, the question of administration of this sort of work in its final form: Is it to be under the supervision of the board of health of the community, or the board of education? What are the difficulties that he has met, and how have they been solved?

My personal feeling is that the sooner we get most of these things into the hands of the board of education, the better; and for this reason in most public school systems, where there are trained dieticians, it is a great deal easier to turn this work over to the dietician, rather than to pay a public health nurse and give her a long training in order to make a dietician out of her.

Where you have the good fortune to have the board of education and the board of health working together, the public health nurses of the board of health are enormously assisted in their work of reaching the children who need medical consideration by this filtration process which brings the undernourished into one group instead of wholesale and rather perfunctory handling of all classes. Placing a certain emphasis on these undernourished children is necessary, and having a place in the school system for a child who can be overlooked too easily, is important.

The undernourished children that do not gain in the nutrition classes and whose correctible defects are overcome, present another problem. We began preventorium work in California a long time ago. It began first in connection with my own tuberculosis work with girls. Among them there were a great many young married women who were admitted because they were unpaid workers, and their children presented immediately the problem of tuberculosis infection which I outlined in 1913, in discussing early manifestation of this infection.

At that time I was tremendously impressed with the fact that good nourishment did not prevent tuberculosis, because in Chicago I stood at the slaughterhouse and watched pigs being killed, and learned for the first time in my life some interesting things about tuberculosis. One of them was that in the United States inspection of hogs 93.7 per cent. of the hogs slaughtered in the United States have already acquired tuberculosis infection. Now, the hog is the fattest animal we know, and for economic reason has to be killed by the time it is seven months old, because it gains 90 per cent. of all its weight in that time.

The hog and child strike me as having some things in common. The hog pen is the dirtiest animal home we know and the floor is the dirtiest part of our human habitation. The child on the floor, learning to creep, promptly learns to put its hands into its mouth, conveying thither any infection that may have been tracked into the house. Flesh alone is not protection against this disease, and the child and the hog suffer from their immediate environment.

The nearer I get to the tuberculosis problem with children, the more I see how essential it is that we must work hand in hand with the child

welfare workers; and I want to speak here of one thing referred to by Dr. Emerson. I think it can probably be said by me more plainly; and that is as compared to the Modern Health Crusade work, this malnutrition work is about one hundred times more important in the whole tuberculosis problem; and I am very glad to hear that the Modern Health Crusade movement is going to modify its schedule to lay great emphasis on malnutrition.

It would seem to be highly desirable to adopt Dr. Emerson's schedule for the undernourished child and make all of its chores the things he would prescribe for those children.

I was sorry to hear Dr. Hess say that there was any chance of his losing out in that splendid work he has been doing. It will encourage him to know that we do not believe it will ever be stopped. We have three preventoria in operation in California now and are going to open six more this year. We are going to take care of those children in the malnutrition classes who fail to get along well even when medical difficulties have been corrected.

Our experience with preventorium work is that we can't do much in less than three months. We can do many things toward overcoming malnutrition in the summer camps but not with the child who has the problem of tuberculosis to fight. That child must have not five hours of care, five days a week, *but 168 hours every week* for many months. He has to remain under supervision all the time and you will never get those children to a point where they are really resistant to disease such as tuberculosis or overcome the infection and develop the necessary amount of immunity unless you can have them not only three months, but as with most of our children, nearly a year. Even with the best care in the world, with all the medical correctives we can give them, we have had the weight line discouragingly slow in coming up to the normal, and right in the midst of the best conditions we can surround them with, we have had one case of tubercular meningitis develop. We have not taken any child who had open tuberculosis in the beginning.

I want to speak of one thing which I know you will all be glad to hear about. Mrs. Ira Couch Wood, director of the Elizabeth McCormick Memorial Fund, on a visit to us in California, made a rather interesting suggestion about which we hope to make a report in another year. Through Mr. Hoover, the Carnegie Fund gave to Stanford University some $750,000 to conduct experimental work on nutrition. Dr. Alonzo E. Taylor, a well known authority on nutrition is to supervise the expenditure of that fund. We hope to use the public school children of San Francisco as a colossal experiment in child nutrition. Thirty thousand of them have been surveyed and Mrs. Wood promises to organize the nutrition work in our public schools. There is great reason to feel that our local Board of Education will encourage this as they have the health problems of our children well in mind. We want Dr. Emerson's help in this matter because we feel it is one of the most important opportunities in the world to study nutrition without the handicap of cost and with all of the opportunities for going into the thing scientifically that such a fund offers.

George J. Nelbach, New York: I should like to ask Dr. Emerson some questions with regard to the program he described to us this morning. What is the maximum number of children that a nutritional unit can effectively take care of? Does Dr. Emerson or anyone here know of any rural community where this nutritional program has been effectively applied? I refer particularly to a rural community where they have the regular or ordinary one room or two room school. My third question is this: What does Dr. Emerson think about the qualifications for nutritional workers alluded to by Miss Stringer?

Apparently from Miss Stringer's remarks, there seems to be some difference of opinion as to what should be the qualifications for nutritional work. I am a state secretary and I am interested in this kind of work. I should like to know how to apply it and, of course, the question of training of nutrition workers is very important.

R. E. Luhn, Oklahoma City: I have a similar question. In our community we have some 15,000 school children, and referring to Dr. Emerson's figures, our own findings show that about one-third have defects. The question with us is to have some broad program to cover this entire group rather than an intensive program for a few children.

Our tuberculosis society has conducted a demonstration with what we call an open air school with a capacity of only eighteen children, along as intensive lines as those advocated by Dr. Emerson. We have used his methods under a very competent nurse through a tuberculosis dispensary, under their physician's guidance and under the school physician's guidance also, and our results are all that could be hoped for. The school physician opposes the extension of the plan because of the expense and would prefer to cover this entire group of undernourished and defective children. Such a plan would appeal to his school board.

Miss Katherine B. Beach, Sayre, Pa.: I would like to ask if Dr. Emerson has followed up "graduates" of the early nutrition classes, and if so, how they have stood their high school work?

R. V. Spencer, Boston: I should like to ask Dr. Emerson if he has a record of the percentage of children who have not responded to at least two years of home treatment under his direction and also the percentage of this number who have later been sent to institutions and have responded under full time institutional treatment.

Miss G. I. Pelton, Denver: May I ask if any effort is being made to bring the seriousness of malnutrition in children to school boards and school superintendents and even to school physicians?

Dr. Emerson: These are indeed very interesting and vital questions to all of us. Fortunately we do have a measure in this work, we have a measure of pounds and clinical evidence as to results, and I want to say that when I began this work I had a lot of theories that it took me three years to get rid of. I had difficulty in accomplishing this, having been born and brought up in New England.

Then I decided that I would get what ideas I could from the children

themselves so I have to say that most of this information is from the study of the children themselves and not from anything else. We are working for results not theories.

I am very sorry about the confusion that arises from the words nutrition and diet. What is nutrition and what is the chemistry of nutrition? Is it the chemistry of diet? They are so interwoven that they are used interchangeably. I can show hundreds of charts of children having three thousand, four thousand, five thousand and six thousand calories daily and not gaining an ounce. It is not what the child eats, it is what he absorbs and there comes the question of overfatigue which is of the greatest importance in this work.

We can't get the children to gain unless we have the essentials right and there is no use of running a nutrition class with the school board against you. How can you get an overfatigued child to absorb and gain? I can't and you can't.

I will not conduct a nutrition class in a school with the school board or school principal against me, neither will I conduct a nutrition class with the parents against me. This is the parents' job, we are helping them. We say, "Look at the child. Are you satisfied? If you are, take him away. Are you Christian Scientist? Take him home. Do anything you want, the law says he is yours if you don't break the law of cruelty to children, take him because he is yours. It is not health regulation, it is health education, but if you want us to help we will help you." You can not cure a child when there is too great pressure of school. In Massachusetts we have wicked one day sessions from eight-thirty until one-thirty and in one high school there is no recess until two-thirty.

Now someone asked if we talked to school boards and doctors. We do; both have a right to be informed of the basis of this work. We have in Rochester a Superintendents' League, which says that the nutrition work ties up the home with the school. It is fundamental and when we have the nutrition class, we insist that the parents be there. If the mother can't come, then the father.

Here is a chance to coördinate the employee with the employer. We notify the employer that John Jones, who is his employee, has a child who needs treatment and we want him at ten-thirty, and that is the way we tie up the work with labor. There are some poor children who need a friend and to whom you can give a boost, but if you have them at a preventorium at large expense, always insist that the father and mother attend the demonstration on all the essentials of health, rest, air and food and when the child goes home have them continue the program there.

Open air schools everywhere get filled up at the expense of the state and the parents sit back and say, "Get them well if you want to." No public school should maintain an extra course in an open air school without insisting that the father and mother come to the weekly weighings.

I want to say one other thing. This is a problem of the rich as well as the poor. In the East Side here in New York we found that the percentage was only eighteen. In the better section of a city it is frequently

higher, for instance, in the city of Rochester, N. Y., it was thirty-six per cent. In Chicago in the stockyards it was fourteen per cent. and in a better section forty per cent.

I was up in New Hampshire recently where we weighed and measured children of the poor mill people. They have lower percentage of malnutrition than the families in the more well-to-do districts. Malnutrition comes in part from overindulgence and lack of home control and overfatigue and all these things affect the wealthy as well as the poor.

Miss Stringer spoke of the pre-school child. That is the age when there are so many infectious diseases. It is the most neglected period of the child's life. All children should be up to standard before being admitted to school.

I am glad of what Dr. Hess said about sunlight because we have found if we can get a school board to excuse a child at ten-thirty, after he has been there about an hour and a half, to go home and get his lunch, which ought to be supplied by the parents, they can supervise the rest period right at home. Then the child gets the air and sunlight at midday. We can get wonderful results in the child's own home if we can get that into the school program.

Dr. Brown spoke of 168 hours a week. There is no use of having a nutrition class one hour a week when the other hours are against you. You cannot get the children well without insisting that the parents do the job the rest of the time.

Mr. Nelbach asked about the maximum number of children that can be handled. One nutrition worker to five hundred children would mean that one nutrition worker could take one-fifth or twenty per cent.—the worst of them, and handle the nutrition classes, one class a day, twenty in a class. That is the unit we have had in Walpole, one worker to five classes.

The rural community needs help and we have not touched the rural problem at all except from certain of our nutrition workers who have gone into the rural communities. In Walpole we took a whole town and these same problems can be solved, I believe, in one place as well as in another. Of course, if there is only one room with say twenty children, then put up a screen in one corner of the room and have them lie down in the morning. Of course there are a thousand excuses against this, but we want ways to do this work and it can be done just as well in a one room school as anywhere.

Now as to the qualifications of these nutrition workers. We find the nurse, the dietician, the home economics worker and the social worker all make excellent nutrition workers if they have personality and interest in the children together with special training in nutrition work.

In Grand Rapids we are doing the work with the school nurses exclusively, under the board of health. In Rochester we are doing the work under the board of education. Let me answer a question right here. This work is health education and not health regulation. The board of health is principally concerned with health regulations. This work is more educational and therefore the first thing to do in any town is to interest

the board of education. The work belongs squarely in the school and with the board of education supporting you and the superintendent of schools back of you, you can get ahead.

Now in regard to follow-up work. I am inclined to believe that a malnourished child brought up to normal is more apt to remain well than one who has never been malnourished. I am inclined to believe that the chances for his health are better than for the other. Why? Because you have taught him how to be well. You have given him health education and when he gets up to normal weight he has developed a character that makes him well. In this group from the time they come up to normal there is a character transformation that is remarkable. It is not an easy thing for a boy to come in off the street and take a rest period. It is not easy to stop tea and coffee. You have therefore developed his character, given him health education, and therefore he will stay well.

In Boston I thought we should be obliged to have a class for relapsed graduates, but that idea has been gone for some time. These children come in, drop behind a little and then settle down to business, and if you once get them up they stay up to normal almost invariably, unless there is some strong force like school demands or sickness that brings them down.

I think I have covered every point except one. If we are working with children ought we not to be honest with them? If we say, "Do this and you will be well," ought we not to see that they are well? If we start on any program, should we not see them through? If a child doesn't gain after he has played the game honestly with us and done the things we have asked him to do, we ought to see him through. Nature intended these children to be well and they all can get well. Remove the cause and they will. Therefore, I feel that we ought to see this thing through. Every child up to normal.

AMERICAN SANATORIUM ASSOCIATION

SIXTEENTH MIDWINTER AND SPRING MEETINGS

SIXTEENTH MIDWINTER MEETING
OF THE
AMERICAN SANATORIUM ASSOCIATION

THE Sixteenth Midwinter Meeting of the American Sanatorium Association was held on the invitation of the Board of Managers and Superintendents of the Monroe County Sanatorium, Rochester, New York, on December 11, 1920.

There were seventy-four members and twelve guests present at the meeting, besides the sanatorium staff.

The meeting was called to order at 10 A. M., with Doctor Lawrason Brown, president, presiding.

The secretary reported resignation of Dr. H. A. Latane because of separation from sanatorium work, and the death of Dr. J. A. Rutledge in February, and the following applications for membership, all of which were favorably acted upon:

Dr. Ethan Allen Gray, 2450 Howard St., Chicago, Ill.

Dr. Harold T. Brown, State Sanatorium, Raybrook, N. Y.

Dr. William Charles White, Tuberculosis League Hospital, Pittsburg, Pennsylvania.

Dr. Hobart Van Nostrand, State Sanatorium, Raybrook, N. Y.

Dr. Louis Mark, Rocky Glen Sanatorium, McConnelsville; O.

Dr. J. G. Pace, Modern Woodmen of America Sanatorium, Woodmen, Colorado.

Dr. William J. Enders, Home for Consumptives, Chestnut Hill, Pa.

Dr. W. P. Brown, Mississippi Valley Sanatorium Association, Mt. Vernon, Ohio.

Dr. Jabez H. Elliott, 11 Spadina Road, Toronto.

Dr. Joseph L. Spruill, Sanatorium, N. C.

Dr. Robert L. Bartlett, Oneida County Hospital, Rome, N. Y.

Dr. Frank C. Anderson, Ohio State Sanatorium, Mr. Vernon, O.

Dr. Grover A. Silliman, Delaware County Sanatorium, Delhi, N. Y.

Dr. William A. Bing, Ontario County Sanatorium, Canandaigua, N. Y.

Dr. William F. Williams, Gaylord Farm Sanatorium, Wallingford, Connecticut.

Dr. Cole B. Gibson, Meriden Sanatorium, Meriden, Conn.

Dr. B. F. Kweece, Bon Air Sanatorium, Bells Camp, Pa.

Dr. LeRoy F. Holter, Oswego County Sanatorium, Richland, N. Y.

Dr. Charles A. Parcells, Columbia County Sanatorium, Philmont, N. Y.

The treasurer's report indicated a continuing deficit, but it was felt that

this would adjust itself in the course of the next year. The usual auditing committee reported the treasurer's accounts correct, and on motion, the secretary-treasurer's reports were approved. Instructions were given to serve the usual notice on members who were two years or more in arrears in dues, before dropping their names from the roll.

On behalf of the National Tuberculosis Association, the secretary presented a communication with regard to the institution of a nation-wide mail follow-up system of all ex-sanatorium patients, the collected records to be tabulated in the office of the National Association, the understanding being that institutions doing this work at the present time need not change their system in any way; merely abstracting their reports for the simpler reports of the National Association. Others, who are not doing it, are to send the cards to their ex-patients, keeping the return card and forwarding a duplicate to the National Association, the National to pay for the cards and postage. The approval of the American Sanatorium Association was voted for this scheme, and their support in carrying it out, pledged.

Dr. Pattison of the National Association also presented a scheme for following up in their homes in various cities, towns, and rural areas throughout the country, certain groups of tuberculosis cases by sanatorium extension treatment and observation, the aim being to pick out a certain number of cases of incipient and moderately advanced pulmonary tuberculosis who would be willing to go to a sanatorium for a period of not less than three months, so as to bring about a quiescence of disease and receive instruction, these cases then to be returned to their homes and treatment continued under the supervision of a nurse, whatever local agency best fitted into the situation assuming this responsibility. Such a plan would require coöperation between hospital superintendents and the National Association, which would undertake to see that the continuity of supervision was not broken when patient returned home.

On motion, Dr. McSweeny, Dr. Lyman and Dr. Klotz were appointed a committee to consider this matter and confer with the representatives of the National Association with regard to it.

Mr. Hochhauser, representing the Altro Workshop in New York City, presented the matter of the work which the shop was doing, and asked the support of the Sanatorium Association in the purchase of its products.

In order that there might be ample time for consideration of nomination of officers to be voted upon at the next annual meeting, the president appointed the nominating committee at this time. Dr. Klotz, Dr. Bosworth and Dr. Chadwick were named.

For the scientific discussion, the topic "Early Diagnosis of Tuberculosis — Its Status To-day" was taken up. Dr. Bray spoke of the question of physical signs; Dr. Amberson and Dr. Callahan on x-ray; Dr. English and Dr. Heise on differential diagnosis and tests; and Dr. Coolidge on constitutional symptoms. General discussion was participated in by many members.

EARLY DIAGNOSIS OF TUBERCULOSIS — ITS STATUS TO-DAY

Abstract of Speakers' Remarks

Dr. Bray: Physical signs associated with early pulmonary tuberculosis differ but slightly from those encountered in health. Diagnosis by this mean is, therefore, difficult. Comparative study made of 224 healthy individuals as determined by history, physical signs and x-ray, indicated depressions above and below the clavicle in but 16 per cent. less than those encountered in early pulmonary disease. Variations in the two sides were equally noticeable. These are due to spinal curvatures and shape of the clavicle, changing its relation to the shoulder girdle. Clavicular shapes should, therefore, be kept in mind in estimating this factor. In percussion, the difference between the two sides in a healthy chest is far greater than that found in the tuberculous. Altered breath sounds, particularly prolonged respiration, were found in 33 per cent. of the healthy cases, more marked on the right than on the left side in 65 per cent. of these, but in left apex lesions, where the right apex is free, the expiration is usually more prolonged in the healthy right apex, suggesting that early tuberculosis has little influence in producing this sign. The most important sign is the Grancher type of breathing. Adventitious sounds are, after all, the only reliable indication which we have; the latent persistent rale is most important.

Dr. Amberson: Poor technique and lack of uniformity in technique lead to more trouble with the use of the x-ray in diagnosis than anything else. General hospitals seem more often to depend on poor plates, and a greater general proportion of stereoscopic plates is necessary, than with good plates. Variations in interpretation play an important role. Serial plates are of great value especially in avoiding subsequent breakdowns, as they frequently give warning before the symptoms of further changes in the lesion and approaching trouble. The modification of the National Association classification so as to include x-ray findings would be very desirable.

Dr. Callahan: Sanatorium physicians are frequently embarrassed by patients being sent in by general practitioners who have made diagnosis by the x-ray. Sometimes the plates which are sent with the patients are worthless, or the conditions have been misinterpreted. Stereoscopic plates are not only of immense value in making the diagnosis, but perhaps as often in excluding a tuberculosis which has been diagnosed on clinical findings.

Conclusions

1. Insidiousness being the only constant characteristic of the onset of tuberculosis, elaborate enumeration of minute constitutional symptoms of early tuberculosis is useless, as these symptoms are probably related to a pretubercular condition which promoted the activity of the tubercular lesion.

2. Assuming that the disease phthisis has its beginning in the activating of an infection previously introduced into the lungs, a diagnosis to be early must be made at the time the activating process takes place, or at latest before the symptoms of marked toxemia appear.

3. An early diagnosis precludes a multiplicity of constitutional symptoms called a "toxic group" as marked toxemia is evidence that the diagnosis is not early.

4. The only real evidence of toxemia in early tuberculosis is fever, and that of a low degree. Slight fever will usually be found if search for it is thorough.

5. Malaise may be an evidence of toxemia if associated with fever, but alone may be due to other causes. It is the first symptom mentioned by the majority of patients.

6. Loss of weight alone may not be pathological; associated with malaise suggests the pathological; associated with malaise and fever assures the pathological.

The trio — fever, malaise and loss of weight form a safe basis for diagnosis of phthisis even in the absence of local symptoms.

7. In doubtful cases the patient should be given the benefit of the doubt and given tuberculosis treatment.

Dr. Heise: In order to make a diagnosis, we must have the proper history, laboratory tests, x-ray and the proper physical examination. There are at least 65 or 70 diseases that are confused with tuberculosis. Perfection in each one of the facts enumerated should be sought, as the only positive evidence is the presence of tubercle bacilli, and this is often demonstrated with difficulty. In speaking of differential diagnosis we must keep in mind that this is the one and only positive differential evidence. We have no symptoms which make a diagnosis positive, although there are certain symptoms, and particularly groups of symptoms which make is probable and at times very probable. Complement fixation reactions are confusing.

Dr. English: The condition most commonly confused with tuberculosis is the aftermath of influenza. In such cases, unusual care is necessary. The published reports of autopsy findings in tuberculosis hospitals and our own clinical experience indicate many wrong diagnoses. Syphilis and hyperthyroidism seem to be the chief stumbling blocks.

Discussion

In the discussion, Dr. Alfred Meyer accentuated the necessity for ear training for its value in percussion and auscultation. He also spoke of the usefulness of the bedside x-ray unit.

Dr. Rockhill, in commenting on the x-ray in diagnosis showed lantern slides of children, illustrating the uniform inception of the disease at the hilus. He stated that he believed that malaise was not due so much to the accumulation of toxemia from the site of infection as the inability of the weakened circulation to carry it away. The lowered blood pressure was indicative of peripheral dilatation, and this meant sluggishness of circula-

tion. Fatigue and dyspnoea implied merely lack of circulation to carry away the broken down products of over-metabolism.

Several members commented on the question of other focal infections as confusing diagnosis, and the multiple difficulties in obtaining temperatures and temperature records, the commonest errors being elevated temperatures in general and insufficient exposures to the thermometer when taking temperatures by mouth.

Dr. Tewksbury called attention to the necessity of early diagnosis of pulmonary abscess as well as early diagnosis of tuberculosis following acute lung conditions. Nasal sinus cases, an operation on nose and throat followed by cough should be suspected of abscess rather than tuberculosis. He said he had obtained excellent results with pneumothorax in these cases.

Dr. Lloyd called attention to difficulties which had been encountered in applying the National Association's standard of diagnosis in children, owing to the belief that many conditions in children begin at the apex and not at the hilus, at all events, so far as practical considerations were concerned.

Following the discussion, on motion, a committee consisting of Dr. Amberson, Dr. Rockhill and Dr. Craddock, was appointed to consider the question of recommending the modification of the present classification, by including x-ray findings, the committee to report with recommendation at the next meeting.

On motion of Dr. Alfred Meyer, a resolution was also adopted that the attention of the National Association be called to the advisability of serial x-ray studies of the lungs, with regard to tuberculosis, in infants and young children, as a valuable research matter.

The Committee on "Standards of Construction for Sanatoria" reported progress and promised submission of their full report at the next meeting.

The Association was entertained at luncheon by the Sanatorium; and in the evening at dinner at the Rochester Club, by the Board of Managers. An inspection of the institution was made, and thanks voted to the Superintendent and Board of Managers for their hospitality.

On leaving the institution, a visit was paid to the Eastman Dental Dispensary.

SIXTEENTH SPRING MEETING
OF THE
AMERICAN SANATORIUM ASSOCIATION

THE meeting was held in the Waldorf-Astoria Hotel, New York City, on June 14, 1921, the morning session at 10 and the afternoon session at 4. The morning session was opened by Dr. Bowditch presiding in place of Dr. Lawrason Brown, who arrived a little later.

REPORT OF THE SECRETARY

It was resolved, upon motion, that the minutes of the previous meeting of the Association, which had been printed in the Transactions of the National Tuberculosis Association, be adopted without reading.

Resignations were reported of Dr. Foster Murray and Dr. Edward Richard, both of whom are no longer connected with sanatoria, and of Dr. L. S. B. Robinson, who is unable to attend meetings.

The following deaths were reported: Dr. O. F. Kunkel of the Bon Air Sanatorium, Bells Camp, Pa., and Dr. A. G. Kessler of the Sunnyside Sanatorium, Crookston, Minn.

Applicants for membership were received from:
Dr. H. L. Smith, Watertown, N. Y.
Dr. F. W. MacSorley,, Albany, N. Y.
Dr. A. J. Davis, Nassau County Sanatorium, Hicksville, N. Y.
Dr. John I. Pinckney, Western Maine Sanatorium, Hebron, Me.
Dr A. B. Wickham, Detroit, Mich.
Dr. L. J. Moorman, Oklahoma City, Okla.
Dr. Robert H. Lambert, Cincinnati, O.
Major F. H. Smith, Washington, D. C.
Dr. D. C. Martin, New York City.
Dr. R. H. Morgan, Mt. McGregor, N. Y.
Dr. O. O. Miller, Louisville, Ky.
Dr. A. H. Stanhope, Middleton, Mass.
Dr. F. L. Loveland, Topeka, Kansas.
Dr. Ernest Coope, State Park, S. C.
Dr. H. M. Worthington, Quincy, Ill.

The report of the treasurer for the period, December 11, 1920, to June 14, 1921, was read:

Expenditures (including deficit from last year)	$200.13
Receipts (dues to June 14, 1921)	163.28
Deficit	$36.85

Approved on report of auditing committee.

The Nominating Committee reported the following nominations:
Officers for the coming year:
President, Dr. Lawrason Brown, Saranac Lake, N. Y.
Vice-President, Dr. David R. Lyman, Wallingford, Conn.
Secretary-Treasurer, Dr. E. S. McSweeny, New York City.
The officers were unanimously elected.

The secretary then read a letter from Dr. Charles J. Hatfield, Managing Director of the National Tuberculosis Association, in which he suggested that two members of the American Sanatorium Association be appointed to serve with three members of the National Tuberculosis Association, this committee to prepare a set of minimum standards of discipline of ex-service men under treatment for tuberculosis in accordance with a request for same sent to Dr. H. A. Pattison of the National Tuberculosis Association by Dr. Haven Emerson, Medical Advisor of the Treasury Department at Washington. On motion, the President appointed Dr. W. J. Marcley and Dr. H. D. Chadwick.

The secretary also read a letter from Dr. Haven Emerson addressed to the American Sanatorium Association regarding the problems which the Bureau of War Risk Insurance is attempting to meet in the hospitalization of its patients, and the criticism which has been aroused by using hospitals and sanatoria whose facilities and service were not of the highest type. The special problem is to determine upon the minimum requirements which the Bureau will expect in civil hospitals, and Dr. Emerson presented a tentative list of such requirements for criticism and suggestions.

It was moved and seconded that a committee be appointed to go over these fourteen requirements and compare them with the Sanatorium Administration Standards, and that this committee make their report at the afternoon session with recommendations. A committee was thereupon appointed, composed of Dr. P. K. Brown, Dr. G. T. Palmer and Dr. Bayard T. Crane. The report as presented and accepted later is as follows:

MINIMUM REQUIREMENTS FOR TUBERCULOSIS HOSPITALS, REPORT OF COMMITTEE OF THE AMERICAN SANATORIUM ASSOCIATION

1. *Resident trained nurses* — not less than 1 for each 10 patients or any part of 10.
*(One nurse, not necessarily trained, for every 10 bed patients — 1 to 15 otherwise.)

* Recommendations.

2. *Resident physicians skilled in tuberculosis* — if not living actually on the premises, to be available in five minutes or less.

(We like the phrase "skilled in tuberculosis" not included in Sanatorium Standards, but we do not feel the "available in 5 minutes rule" is either reasonable or practical. Suggest "readily available.")

3. *Satisfactory sanitary conditions* as regards toilets, baths, water supply, cleanliness of buildings, etc.

(In regard to sanitary conditions (3)
fire protection (4)
laboratory facilities (7)
nose, throat and ear (8)
outdoor sleeping facilities (10)
we feel that Class B Standards should be lived up to, and we recognize the improvement over Sanatorium Standards of a specific requirement for removal of bed-ridden patients.)

4. *Satisfactory fire protection* for all classes of patients and perfect fire protection for bed-ridden patients.

(See 3.)

5. *Satisfactory treatment conditions* including measures for enforcing suitable discipline and to prevent absence without leave and to prevent excessive exercise whether from amusements or otherwise.

(5, 6, 12 and 13. We recognize that the biggest problem in sanatorium treatment is in the proper control of ex-service patients; to curtail absences with leave — none in first two months and not to exceed 2 days per month thereafter; to prevent absences without leave; to prevent unsupervised exercise, and we are in accord with the plan on foot to adopt and publish for general use — "Minimum Standards of Discipline as Proposed by Special Commitee.")

6. *Suitable rules prescribed* for conduct and published, providing for satisfactory regimen of treatment.

(See 5.)

7. *Satisfactory laboratory* facilities providing for at least sputum and urine examinations at the place.

(See 3.)

8. *Specil treatments* as of nose, throat and ear provided by a properly qualified physician.

(See 3.)

9. *No extra charges* to be made the patient for thermometer, sputum cups, reclining chairs, blankets, medicines nor for any other article of a similar nature furnished without charge to a patient in Government sanatoriums.

(In view of the fact that the care of ex-service men in Government hospitals is costing the Government in some cases far in excess of the amounts generally paid to private institutions, we recommend that the rates paid to private institutions be increased where the service is satisfactory to at least the minimum cost in government hospitals, thus obviating the necessity for any extra charges.)

10. *Outdoor sleeping facilites* or in lieu thereof, provisions for unlimited ventilation of rooms.

(See 3.)

11. *All rooms and porches to be screened* against flies and mosquitoes during the season.

(approved.)

12. *Patients to be taught the elementary principles* necessary to secure co-operation in treatment.
(See 5.)
13. *No charge to be made for patients absent more than 24 hours* from hospital.
(See 5.)
14. Keeping of clinical records.
(A satisfactory medical institutional and disciplinary record should accompany the application for admission of each ex-service man to a new institution.)

On motion of Dr. Pettit it was resolved that these suggestions in the Minimum Requirements for Tuberculosis Hospitals be adopted.

The secretary announced that two invitations for places at which to hold the mid-winter meeting had been received from Dr. Pettingill of the Essex County Hospital, Mass., and from Dr. Runnells of Bonnie Burn Sanatorium, New Jersey. The matter was referred to the executive committee.

It was resolved that the report of the Committee on Standards for Sanatorium Construction be printed and distributed among the members of the Association, to be taken up at the next meeting of the Association, and the committee continued. The committee reports as follows:

The committee on Standards for Sanatorium Construction has held two meetings during the year. It presents hereunder a corrected report of its minutes.

Robinson Bosworth, M. D., Chairman,
John J. Lloyd, M. D.
Albert H. Garvin, M. D.

June 13, 1921.

PRELIMINARY REPORT OF THE COMMITTEE ON STANDARDS FOR SANATORIUM CONSTRUCTION

For guidance in the further work of the committee, it is believed necessary to state the problem in construction as it must be met by varying types of community. The committee believes that documentation on sanatorium construction, as has been presented up to the present time, while serving a very useful field as an aid to construction, is now failing to adequately meet the problem, because the development of such construction quite generally falls into the hands of laymen.

These interested laymen are usually active in futhering some one type of construction for the tuberculous — such as the construction of a children's hospital, or a sanatorium for early cases, or a county sanatorium, and, rarely, a hospital for advanced cases.

With the aid of the present information, supplied by the National Association, and quite as frequently without this aid, interested lay travelers, often representing huge resources, start on a sightseeing tour to see what has been done for the tuberculous in communities other than their own. In the course of their travels they may meet with someone who takes enough interest in them to inquire into

their problem, to obtain the abstract information concerning it, and to direct their further investigations in a way that they may more accurately appraise what they see.

It seems necessary to lay out a building program for different sizes of community, both rural and urban — such a plan as will completely cover the tuberculosis problem. It seems that the type of structure should be so presented that there are at least three solutions for each problem. If all of the types of community are embraced in this type of study and program, even a casual layman would be enlightened as to the position and size and relation of the particular unit that he was planning in the tuberculosis structure. In addition to aiding him in a more complete understanding of the part of the work he is attempting, it would also inform him of other and, perhaps, unthought of parts of the tuberculosis work that involved construction.

Hospital construction, as distinct from sanatorium construction, should be included, and dispensary construction should also be added. If the layman were to see a plan for a complete division of tuberculosis that perchance fitted his community as to size, social structure, and economic state, the aid in realization of its accomplishment might be considerable.

The tendency of large cities to combine with the county territory for administration somewhat simplifies the classification of communities as to size, and the committee suggests for a tuberculosis plan the following size communities:

First class.	Population 175,000 and above
Second class.	Population 50,000 to 175,000
Third class.	Population 50,000 and under

In making this classification the committee proceeds on the supposition that in communities of 175,000 and over the immediate county tuberculosis problem shall be an integral part of the community tuberculosis program. In communities of from 50,000 to 175,000 the same general state of affairs would hold.

In communities of the first and second classes it is reasonable to expect a considerably developed general medical and public health program embracing equipment for the surgical and medical needs of the community, and that the tuberculosis work will form a division of the general medical work of the community and will be intimately connected and associated with it.

Communities with a population of 50,000 and below, which may be rated as communities of the third class, may have a population so dispersed that the means of support for general medical and surgical units do not seem available. If a sanatorium or hospital is constructed which meets with the minimum requirements of the functional standardization already completed by this association, there is much equipment included that might function from a general medical standpoint. In communities or counties where no such diagnostic aids as laboratory and x-ray are available, it is reasonable to expect the sanatorium or the hospital-sanatorium to function in terms of a general diagnostic clinic where the laboratory or the x-ray may be of aid.

For communities of 175,000 and over, it is suggested to plan structures and beds in the following ratio:

Death Rate per 100,000 No.	Five times death rate = case rate No.
1. Hospital for advanced cases	8 per cent. of case rate
2. Sanatorium beds for early cases	8 per cent. of case rate
3. Preventorium beds for children	4 per cent. of case rate
4. Beds for treatment of bone and surgical tuberculosis	2 per cent. of case rate

5. Open air schools	0.7 per cent. of total school population.
6. Open air rooms	1 per cent. of total school population
7. Beds as supplement to custodial service	1 bed to 15,000 population
8. Tuberculosis dispensaries	1 to 100,000 or 200,000 population.

For cities of the second class
(same as above)

Communities of the third class.
(same as above)

It is proposed that three theoretical solutions be laid out for each one of these problems. It is appreciated that such an attempt would excite the severest criticism; nevertheless, it is believed that it is only by the approach to the problem as a whole, by the illustrative method, that the most rapid advance can be made. Such an attempt will develop the freest criticism of the mistakes municipalities and communities have made up to the present time in the program as at present developed. These objections will be listed so that they may be avoided by the communities doing extension work or inaugurating complete new tuberculosis program.

Following these nine solutions a rather widely gathered set of plans from other countries than America may be added to the American documentation plans, particularly from England, France and Germany, and to this end the committee has accumulated a partial documentation of this material from these countries. It is also believe that the Carrington book material may be added to and subtracted from in part for the illustrative material that it contains.

The above outlined procedure would embrace a volume of 100 pages or more, either bound or loose-leafed, principally plans and illustrations.

A second volume of more technical interest to architects is suggested under the title—"A Guide to Tuberculosis Hospital and Sanatorium Construction." The word "guide" is suggested to avoid the word "standardization," as individuality in external form is the thing to invite, and new workers in the field may develop more pleasing structures than have been developed to the present time, and without added expense.

Should this "guide," and should the above plans, be worked out with the authority of the Sanatorium Association and the National Tuberculosis Association, they would aid greatly in the giving of advice that the National Association is called upon to supply in an increasing degree, and would short-cut the time of preliminary study consumed by architects who meet the problem for the first time. The type of this book is suggested as somewhat comparable to Mills' "American School Building Standards," or Stevens' "The American Hospital of the Twentieth Century."

This book should consist almost entirely of a description of various details that are accessory to the special work of each assigned space. As an illustration—adequate immediate closet and storage room is frequently not available for the accessory equipment or furniture which plays an immediate part in the treatment. If this equipment is not for the moment in use, it cumbers the used floor space by its presence. The type of window and porch protection varies with geographical location and with the plan. Window details which are excellent for one climate do not function satisfactorily in another. If all the types of window detail are presented with a candid discussion of their advantages and disadvantages, the architect can make a more certain selection of the type that will be best suited to the treatment purposes and the building requirements of the community.

This seems particularly important, as the tuberculosis problem is moving west into communities where practically no such activity has existed, and present plans are not complete enough to guide architects intelligently in selection.

To title the chapters of this "guide," the following list is suggested:

(a) The selection of an architect;
(Competitions; direct selection; agreements, etc.)
(b) Digest of state laws and regulations for hospitals and sanatorium construction;
(c) The size of the problem in a locality;
(d) The selection of a site;
(e) Buildings: administration;
(f) Patients' buildings: infirmary or hospital;
(g) Patients' buildings: semi-ambulant and ambulant cases pavilions or congregate buildings;
(h) Patients' buildings: semi-ambulant or ambulant cases detached or "cottage" type;
(i) Service buildings: kitchens, bakeries, serving rooms and equipment;
(j) Service buildings: dining rooms;
(k) Service buildings: store rooms, general, meat, vegetable, linen;
(l) Power house and heating plant and equipment;
(m) Sewage disposal;
(n) Water supply;
(o) Laundries: buildings and equipment;
(p) Recreation: buildings and equipment;
(q) Vocational training: buildings and equipment;
(r) Quarters for staff: medical, nursing, general, domestic;
(s) Grounds;
(t) Farms and farm buildings;
(u) Furniture and equipment (probably several chapters as general and technical equipment should be included in cases where it is not dealt with under chapter heading);
(v) Repairs and maintenance: buildings and equipment.

The committee has documented on what might be described as a standard dispensary equipment. A further documentation should be made on equipment for the modern treatment of surgical tuberculosis. This will aid architects in the comprehension of the needs of this type of structure.

Appendix:

List of plans on file at the office of the National Tuberculosis Association.

1. New York State scheme
2. Minnesota State scheme

List of plans in the hands of Scopes and Feustmann, gathered by them partly with the aid of the National Tuberculosis Association as documentation for a book on sanatorium construction. This book has been in the course of preparation for about three years.

The program of the day was opened with discussion of the report of the Committee on Modification of Classification to Include Roentgen Findings. (*Mailed to members; to be printed next year.*)

DISCUSSION ON MODIFICATION OF CLASSIFICATION

Use of the Word "Minimal" to Replace "Incipient"

Dr. Bosworth: Has the Committee taken any consideration of the Rathbun Modifications?

Dr. Amberson: The proposed classification may be used either with or without these modifications. The present official classification of this Association includes the Rathbun Modifications. It remains with the Association to continue it as such or to adopt it in some other form.

Dr. Brown: Use of the x-ray in the classification enables us to use the Rathbun Modifications with a great deal more accuracy. The Rathbun Modifications classify patients on the physical signs, sometimes x-ray shows more and sometimes less. By adding x-ray to this classification, we become very much more accurate. To rearrange this classification, the definition of minimal would be: a slight lesion limited to a small part of one or both lungs; definition of moderately advanced would be: a lesion of one or both lungs, more widely distributed than under minimal, the extent of which may vary, according to the severity of the disease, from one-third the volume of one lung to the volume of an entire lung, with little or no evidence of cavity formation. We have been classifying our patients since 1913 entirely upon physical signs and having nothing to do with the symptoms in the primary classification.

Dr. Waters: I believe that as far as possible we should stick pretty closely to established terms with which we are all familiar, and with which the patients are familiar. I would like to see a term adopted which would contrast more sharply in the popular mind with the other term.

Dr. Pryor: I think the word incipient is thoroughly understood by physician and layman. It has a meaning that has become clear and distinct; the old definition has worked well and has taken into cognizance the clinical features of the case.

Dr. Chadwick: We need some term which will distinguish between the early disease of childhood and the incipient pulmonary tuberculosis as found in the adult. It is hardly fair to classify the child with hilum disease but without pulmonary involvement with an adult with the apex of one lung diseased. There is a great distinction between the bronchial type of tuberculosis in childhood and the early adult pulmonary form of tuberculosis. This term minimal gives us something by which we can describe that early pulmonary form of tuberculosis and distinguish it from the incipient type of tuberculosis which we find in childhood. I should like to see this change made.

Dr. Dunham: If the word minimal is considered a better expression than incipient, I should like to see it changed. I do not think the word minimal is much more accurate than the word incipient. Unless we can have a word that really has a definite meaning to everyone, there is little to be gained by changing one word that does not express what we mean.

Dr. Bartlett: The term incipient implies time element. This causes confusion of thought in the mind of the patient in regard to his disease. The term incipient has been unfortunate in associating time. I think adopting the term minimal would tend to a better understanding of the disease by the patients themselves.

Resolved, upon motion duly seconded, that the term minimal be adopted to replace the term incipient.

Separation of Physical Signs and Symptoms

Dr. Brown: I think it is wise to rearrange this classification according to Rathbun's suggestions and have the definite classification based entirely upon the extent of the disease of the lungs, determined by physical examination and Roentgen findings, and the rest of the classification under A, B and C determined by symptoms.

Dr. Amberson: The Rathbun scheme has its advantages and its disadvantages; in sanatoria where patients are graded for work it is quite an advantage. It does clutter statistical records; instead of having three main divisions we have nine main divisions. Personally, I am in favor of leaving it to the individual. I hesitate in recommending that it be officially adopted because it does mean quite an encumbrance to statistical records.

Dr. Spruill: We have been using Rathbun's Modifications ever since it came out — for some two or three years. I have been very much interested in viewing results of that classification, with great satisfaction. From a statistical point of view, it is well worth it. I should hate to see the Rathbun Modifications cease, and would suggest that the Rathbun Modifications be adopted as a part of the classification and that all institutions report on that basis.

Dr. Klotz: It is extremely important to express clinical symptoms in the classification in some form or another.

Motion adopted that the Rathbun Modifications be adopted and adhered to.

Lesion in Moderately Advanced Cases

Dr. Amberson: We have tried to make it clear that the lesion may be distributed in one or both lungs but the total involvement shall not exceed a volume estimated to be the equivalent of one entire lung.

Dr. Brown: It would be well to try out the scheme before adopting it; give it a year's trial.

Dr. Amberson: Under classification of moderately advanced — severe infiltration with or without fibrosis which may extend through not more than one-third the volume of one lung — we have considered both intensity and extent, and have tried to consider these factors as existing in an inversely proportionate relationship. If there is slight infiltration more extensive than under minimal, that places it automatically in the moderately advanced group.

Dr. Heise: You ought to extend the limit to include one-third of the opposite lung or you will get cases that are moderately advanced included in the advanced group.

Dr. Rockhill: Cases that have an entire lung diseased on one side and one-third of the opposite lung do just the same as those that have a slight infiltration of one entire lung. You should extend the limit of moderately advanced to cover the broader group. It is impossible to classify to suit everybody. The individual looking at this picture will have to reach his conclusion by the amount of lung tissue involved. If you have one side involved but not showing evidence of breaking down, and a small part of the other side, that would include cases of moderately advanced tuberculosis. Aim to put into the classification every condition that you will meet.

Dr. Craddock: A case that shows involvement of half of one lung and half of the other still gives only the volume of one lung. Then if a case had infiltration through a portion of either lung, that would put him in the far advanced class. Total amount of lung involvement in most cases would not exceed volume of one lung.

Dr. McCain: Take into consideration the x-ray. Mighty few cases have one lung involved and nothing on the other side. A good many do not show this on physical findings. We shall have to classify as far advanced a good many cases that are now classified as moderately advanced.

Dr. Amberson: In answer to query as to how measurement is applied — the definitions of the involvement allowed in the moderately advanced group, as stated here, apply to the lesion wherever the location may be. The individual who examines must estimate whether the total involvement equals one-third, one-fourth or one-tenth of one lung. We cannot define exactly because there are no anatomical standards by which we can go. It does not seem quite clear that two lungs may be involved in this group. Maybe we can word it more clearly so there will be no misunderstanding.

Dr. Brown: I suggest taking the whole schema as presented by the Committee and discussing it next year.

Healed Lesion

Dr. Heise: It is a question whether to call a lesion healed which shows no progress one way or another.

Dr. Amberson: We do not know clinically when a lesion is healed. The definition proposed is entirely arbitrary and final judgment is left to the examiner. Under 15 — "Physical signs of a healed lesion" — these may embrace every physical sign of infiltration or consolidation, with the exception of râles which must be *permanently* absent — it was recommended that the word "*permanently*" be omitted. *No decision.*

The discussion was continued in the afternoon, but no further action was taken to modify the Committee's report. On motion, the report

was referred back to the Committee, which was continued with the instructions to print and distribute it as amended with a request to the members to use and study it so that final action may be taken at the next annual meeting.

AFTERNOON SESSION

DR. BROWN, PRESIDING

Miss Alice E. Stewart, general superintendent of the Tuberculosis League of Pittsburgh, spoke regarding the education of student nurses in tuberculosis, and expressed the desire that the American Sanatorium Association should approve their outlines for nursing education in sanatoria and general hospitals.

Dr. White made a motion that these outlines be approved by the Sanatorium Association, saying that they had been prepared with great care by the nurses' associations, the League of Nursing Education and the National Tuberculosis Association, and greatly tended to improve installing better trained nurses in sanatoria. This motion was duly seconded and it was resolved that these outlines receive the hearty endorsement of the Sanatorium Association, together with an offer to the National Tuberculosis Association to coöperate actively with them in this, to urge enforcement in general hospitals and sanatoria, and to show willingness to aid nursing organizations in this endeavor.

On motion of Dr. Klotz, the Chair was authorized to appoint a committee to coöperate in working out this scheme.

REPORT OF COMMITTEE ON SANATORIUM HOME TREATMENT EXPERIMENT.

The Committee reports that it has examined in detail the proposition made by Dr. Pattison on behalf of the National Tuberculosis Association at the Rochester meeting, and given consideration to a recent communication from Dr. Pattison which outlines the methods, records, etc. necessary for this work. The Committee believes that the project is worthy of a trial, and recommends to the Association that it record its approval and express its readiness to coöperate. The Committee is informed that the National Association is now prepared to proceed with the work if this Association approves.

The report of the Committee was unanimously accepted.

EXPERIENCES IN CLASSIFICATION OF SANATORIA

By C. D. Parfitt, M.D.

Calydor Sanatorium, Gravenhurst, Ont.

When asked by the Secretary of the American Sanatorium Association to tell of the use of the Schema of Standardization of Sanatoria by a Board which last year visited most of the Canadian sanatoria, I felt obliged to decline the invitation, since the Schema had not been used, but he then asked me to tell why the Schema had been found impracticable. In the hope that our experiences may suggest some points of value for future work along similar lines, I come, therefore, to recount something of what we accomplished and to tell in what we failed. The subsequent comments upon the application of the Schema which arise largely from this work are my own.

In April, 1920, the Director Medical Services of the Department of Soldiers' Civil Re-Establishment appointed a Board consisiting of:

Dr. J. R. Byers, Dr. W. H. Hart, Dr. A. F. Miller, Dr. D. A. Stewart, and myself, all members of this Association, to study in general the whole question of the treatment of tuberculosis occurring amongst the ex-members of the Canadian and Imperial forces in Canada. The greatest liberty of investigation was afforded at all points. Business details were not specified as part of the inquiry, but special reports were to be made in detail on the several sanatoria in which ex-service men were being treated, regarding:

1. The suitability, sufficiency and efficiency of the plant in general, and its equipment and furnishings.
2. The personnel in general and especially the medical personnel as regards special training and experience in the diagnosis and treatment of tuberculosis.
3. Medical standards and records as regards method and efficiency.
4. Conclusions regarding patients examined by the Board:
    a Patients who have been under treatment for a longer period than five months, with a view to determining whether the Department is justified in retaining them longer in the sanatorium for treatment.
    b Patients of uncertain diagnosis, or those under treatment for conditions other than pulmonary tuberculosis, but who, in the judgment of the medical superintendent, require prolonged sanatorium treatment.

c Any special cases for whom a medical superintendent required consultation.

d All patients in whom poison gas may have been a factor in producing illness (especially those with official histories of exposure), with a view to determining the etiological association of the exposure with the condition for which the patient is being treated.

5. The quality, source of supply, preparation and service, of food.

6. Complaints, which, without prejudice, may have been brought forward by patients, staff or employees, individually or assembled, by the invitation of the Board. These to be forwarded to the Director Medical Services with comments and recommendations.

7. Recommendations as to:

a Necessary or desirable additions to, or alterations of, plant and equipment, especially in regard to improvement of medical facilities.

b Improvements of medical standards and records.

c Modifications of service and policy.

d Concentration of patients whenever practicable, with the closing of unnecessary or less efficient sanatoria.

In addition to the care of patients under treatment the general question of the after-care, and the employment after discharge from the sanatorium of the tuberculous ex-service men was to be given consideration.

The several matters to be considered were dealt with in a series of reports, a brief summary of which was published, and may be obtained by application to the Department. There are many details which cannot be referred to here, but which are related to sanatorium efficiency and standardization.

We visited 26 institutions, 22 of these being sanatoria, and 4 hospitals with tuberculosis wards, with a total capacity of 3560 beds. Reservation of 2227 beds had been made for ex-service men. The institutions varied in size, from 12 to 307 beds, the average being 137. This part of our work took 98 days, 50 days being spent in travel. In the 48 days spent at these several institutions, the Board gave an average of 11.4 hours to the actual inspection of each, or 48 hours from the several members, who numbered five for part of the time only.

The closure of nine institutions, containing 607 beds was effected; detailed examinations were done on 328 of 1436 ex-service men in residence; and statistical data relating to 8571 ex-service patients were collected. Subsequently two of us working together gave four months to the study and classification of the miscellaneous data and the preparation of the several reports, aided by the criticism of absentee members on all points. Time did not permit of the preparation of much interesting statistical material for publication. A comprehensive inquiry at first hand into the perplexities which confronted the men throughout Canada

on discharge gave basic information for recommendations by Parliament for the care and reëstablishment of the tuberculous ex-soldier.

Rather than to attempt a standardization and a comparative rating of the sanatoria, our work was to report, as fairly as possible, conditions as found and to recommend measures for improvement and economy. Before any consideration of method of classification could be made by the three members of the Board at first brought together, we were immediately diverted to report upon the use of certain shops for "substandards" by the tuberculous. This special work and an examination by a Parliamentary Committee took three weeks. We were hampered by this interruption and loss of time in the preparation of the programme of inspection we wished to follow, but this inquiry at the very start proved of utmost importance. It emphasized the fact that "after care" was the great problem before us, and that the opportunity to gain the views of the patients and officials in regard to these problems in different parts of the country, as material for future constructive work, was of much greater importance than the recording of data on, for the most part, known satisfactory institutions.

Our intention was to apply the A. S. A. Schema and three of us went to the St. Louis meeting last year in order to gain the latest information about it. It was, however, not used and this has been a matter of sincere regret, both at the time when we saw the opportunity of using it slipping away, and later when we arranged and epitomized the data collected. As now printed, the Schema calls for so much precise detail that it obviously was impracticable for us with the time at our disposal and the miscellaneous duties imposed upon us. If we had had the foresight and the time to get the then unprinted A. S. A. Schema multigraphed and sent in advance to the several sanatoria for the details to be filled out in anticipation of our visit, our knowledge of conditions after inspection would have been useful in judging the values assigned.

This opportunity, however, was realized too late and it became immediately necessary to devise some plan which would fit our special needs and allow information to be recorded in a rough and ready manner. Matters of interest inevitably presented themselves out of order in regard to any set form, and brief notes at the moment in a rough classification had to suffice. However, a workable plan was devised and used throughout, though this fell short in detail for the ultimate accurate calculation of an index of efficiency. More time spent at each institution would have much shortened the time later necessarily spent upon supplementing information and coördinating the desired data. A composite report of all members was required, in order to avoid bias, so that conservation of time during the inquiry, which would have resulted by each member working consistently on specified details, had to be sacrificed for joint criticism. Though we were unable to use the A. S. A. Schema itself, we included in our plan certain modifications of it, and in the light of our experiences in the Canadian survey some reflections and

comments upon the Schema may be pertinent and I hope not without interest.

The application of the Schema is undeniably difficult. It invites high grading through inevitable self-appreciation. The final classifications appear too high if hard criticism is to be applied. An interested recorder of values may be too lenient to his institution, or actually unfair in his wish not to be biased in its favor. A recorder from outside may be altogether too unfamiliar with actual conditions of need and use to assign proper value. While efficiency of material things — plant, record forms, etc.— can be fairly estimated, the efficiency of operation in different departments must frequently be judged from brief observation only. A fair survey of the details of an institution will, however, enable practiced observers to estimate an efficiency rating which will likely be found not far from that calculated through application of the Schema in detail. It may even prove to be more trustworthy in grading a series of institutions since the impression is based upon dominant qualities. These difficulties, however, do not lessen my desire for a method of numerical valuation and the derivation of an index of efficiency.

Some modifications in the data required and in the method of computation are probable. Detailed though the Schema is now, a further itemization of details by the recorder is necessary in the case of some comprehensive headings in order to reach a fair rating. In some of the present scheduled lists there is reason to think that the addition of values allows material fact to outweight efficiency of use. The averaging of miscellaneous percentages is, of course, never fair since bases of unequal value are then equalized. Here it perhaps cannot be avoided and the different factor weights largely compensate.

Further differentiation of material fact (*e. g.* plant, equipment, number of personnel) from function, the efficiency of *use*, would possibly clarify ideas in application and make the ultimate result a fairer one. The fact value multiplied by the use value gives a resultant efficiency, such as is obtained in rating business efficiencies by the multiplication of factors. This would require three columns opposite the list of details for fact value, function or use value, and the index resulting from the multiplication of these two. The Schema would be broadened but there might be some compensating shortening by the removal of certain use values from the lists to be added up and averaged. This multiplication of factors is now implied in the adoption of the percentage system of valuation and is required in a number of specific instances (*e. g.* accounting which means system multiplied by operation). If an efficiency rating were derived from the multiplication of fact value by function value the ultimate indices of relative efficiency would be much lower than obtain in the present method. For example, a medical service that had eighty per cent. of the equipment for good medical work and used it with an efficiency of eighty per cent. would have an actual efficiency index of

sixty-four per cent., yet both its facilities and use of them may be considered fairly high.

Equally good plants with all necessary equipment may have good or bad management, with resulting different efficiencies. For example, a fine type of dishwashing sterilizer may be viewed with pride by the possessor, but on inquiry it is found that glasses are not sterilized because they break, nor cups because the handles are broken off, nor forks and spoons because they cannot be cleaned well, all these potentially infected articles are cleaned by hand and are not subsequently sterilized. The apparatus is thus used only for the remaining tableware and its efficiency as a sterilizer is reduced almost to nothing. A good x-ray department may turn out indifferent work, and vice versa, or, apart from quality, in one institution this department may be much more used than in another. In these two examples it is plain that the efficiency of use should modify the rating of the equipment. In the matter of records an institution may have a multiplicity of forms and thus score over one with fewer, but the actual notes in the latter institution may be far better and much more than compensate the limited forms. The acquisition of all possible record forms may easily result in lessened efficiency of observation because of the labored detail — thus the wood is not seen for the trees.

Greater flexibility in the Schema is desirable and some space should be provided for data, which ought fairly to be included but for which no provision has been made. Moreover, all the data now asked for are not essential for the efficiency of every institution. If a sanatorium were to provide all plant and equipment called for in the Schema it might be thrown seriously out of balance in relation to its objective and become thereby a relatively inefficient, uneconomic institution. Efficiency is relative as well as absolute. Within reasonable limitations the manner in which a sanatorium with good ideals fulfils its purpose, independent of size, type, and clientèle, is the true index of its efficiency. Here the intangible factor of personality in influence and management enters, which, while felt, is difficult to record.

Some special rating for size, either greater or less than a mean, requires consideration. Larger institutions require higher organization, present greater difficulties in management, and entail greater responsibility. On the other hand smaller institutions are inevitably handicapped by decreased flexibility in organization and proportionately increased overhead expense.

The inclusion of a service index is much to be desired. The efficiency of service is difficult to estimate because of many variable factors: the size of the sanatorium, its facilities, the standards of work maintained, the character of service required, the number and the condition of the patients, the rate of turnover, the number and quality of staff personnel. Since all costs are rated against the patient, the proportion of staff to patients seems a better index for service than the more usual rating of patients to staff. Some definition for calculating this index is necessary, since capacity and filled beds may differ and some institutions are com-

pelled to have services not necessary to others, *e. g.* a farm may be operated, or they may be able to dispense with essential services and plants, *e. g.* laundry may be done away from the sanatorium, electrical power may be supplied from a public service. The self-service of patients should also have some value assigned to it in calculating the service index. A relatively high service index may mean either increased service efficiency for the patients or lessened service efficiency for the institution, while a low index may mean high institutional efficiency, or relatively slight attention to the individual patient. Service efficiency and cost may therefore be in either direct or inverse proportion. The character of service required, as well as the capacity of the sanatorium, is to be considered in rating service. Efficiency of operation may be a matter of local conditions rather than one entirely of ideals or management. All sanatoria have a handicap in efficiency of service through their inevitable limitation in the selection of employees because of the character of the work. This varies with communities, but probably bears hardest upon those most isolated: with these a staff assembled through circumstance rather than choice results.

In the medical service, training, initiative and personality are hard to rate numerically, but an index of the two former qualities can be fairly well shown by multiplying fact by function, *i. e.*, the several record forms by the quality of notes, thoroughness of investigation, and perspective, while the general institutional atmosphere is some indication of the last. While good routine and well kept records are essential for sound institutional work, observation of, and work on the patient are nevertheless of more importance than the actual record and may not be fairly shown in the record because of pressure of work and lack of clerical assistance. If the records become of paramount importance, necessary clinical work may be set aside and observation impaired owing to the time required for less important details. Standardized criteria of diagnosis and classification are of basic importance and if rigidly applied make the manner of record forms of relatively less importance.

The value of the sanatorium and its medical staff to the local community will necessarily vary with the community, but local need, especially in isolated communities, which cannot be denied, may actually impair the institutional efficiency to some degree. Other extramural interests, such as patients returning for examination, new patients coming for consultation, consultation and teaching of staff away from the sanatorium, clinics and social service, may, by their demands, also strain the institutional efficiency of which they are themselves an index of appreciation. Are they to increase or decrease the efficiency rating?

These points in regard to medical services are possibly worthy of more consideration, as is schedule 7, "Instruction for physicians and nurses," than is shown in the values assigned in the Schema. In the grading of institutions by independent observers they must be considered and will inevitably weigh in rating values.

Some concrete formula, it is hoped, will ultimately be obtained, com-

bining the efficiencies of plant, capacity, volume of work, service, and cost, which, in relation to a standard, will give an actual index of institutional efficiency.

No doubt many of the matters here mentioned have received consideration by the authors of the Schema, but a discussion of them as difficulties arising in our experience may throw them into a new perspective. Appreciation of the Schema and of the ingenuity with which it has been constructed deepens with familiarity with it. It is a fine effort of standardization and has already been shown to be practicable — further trial only will show if it is fair. The devisers of the Schema have labored hard and effectively to bring about its present comprehensive practicable form and they deserve our gratitude and earnest coöperation in applying it.

RAISING THE STANDARDS OF PUBLIC TUBERCULOSIS SANATORIA IN ILLINOIS

(The Illinois Sanatorium Pilgrimage)

By George Thomas Palmer, M.D.

Springfield, Ill.

The conditions surrounding public tuberculosis sanatoria in Illinois are such that the elevation of the standards of these institutions requires unusual treatment. Until a very few years ago, Illinois had done less than any of the major states of the Union toward providing sanatorium treatment for her tuberculous people. There has never been a state sanatorium and the state government has never gone so far as to create a commission for the study of the tuberculosis problem, or the creation of a board for the standardization or control of institutions. As late as 1917 there were practically no public sanatoria in Illinois outside of Cook County and the Chicago District.

During 1917, however, the Illinois Tuberculosis Association entered into active campaigns in a large number of counties under the provisions of the very excellent county tuberculosis sanatorium law. The results of these campaigns were exceedingly gratifying. Within a period of four years, about one-half of the hundred and two counties in the state had voted favorably on the proposition of establishing sanatoria free to all persons regardless of financial condition, and establishing free dispensaries and visiting nurse service.

What appeared to be a splendid victory for the state association soon threatened to become a distinct source of embarrassment. The county tuberculosis sanatorium boards in the various counties were, for the most part, made up of men and women who had not had the slightest experience in sanatorium construction, organization, or management, but, with the splendid enthusiasm created by the state association, many of the boards went boldly ahead making mistakes which threatened the future of the entire sanatorium program.

For the most part, the members of the sanatorium boards appeared to feel that the development of a sanatorium is a very simple matter which can be safely entrusted to the local architect and contractor.

In Illinois, as in many other states, the chief relationship of the county government to medical matters consists in the care and treatment of paupers and destitute persons, and it was found very difficult to impress upon the sanatorium boards that, under the provisions of the law, the

Illinois County Sanatorium has nothing more to do with the pauper or indigent person than has the public school system of the state.

On account of the unfortunate exaggeration of the infectiousness and contagiousness of tuberculosis, it was found that the sanatorium boards regarded the county tuberculosis institution as somewhat akin to the isolation hospital or pest house, this sentiment being manifested in the selection of unfavorable and isolated locations and the consideration of pest house types of buildings.

While the State Department of Public Health has certain limited jurisdiction over county and municipal hospitals, its authority extends only to the point of inspecting and recommending changes or improvements, but there is no penalty imposed upon the sanatorium board for ignoring the recommendation of the State Department of Public Health, nor has the department any specific power to dictate or direct methods of diagnosis, treatment, or institutional operation. Under its general powers, of course, the State Department of Public Health can assume supervision of the tuberculosis sanatorium on the ground that it is a place for the isolation of persons suffering from communicable diseases; but this could not be successfully done unless the violation of precautionary measures were flagrant and the institutional management exceedingly bad. In other words, there is no constituted authority in the State of Illinois legally authorized to pass upon the standards of tuberculosis sanatoria.

In view of the mistakes that had been made in the sanatoria already established and in view of the large number of institutions to be established within the next few years, it became imperative that something be done and the State Department of Public Health and the Illinois Tuberculosis Association undertook the inspection and rating of existing sanatoria, utilizing the limited authority given to the Department of Health. By exercising the utmost tact and diplomacy in carrying out the program, but one institution of the twelve in operation offered objection to the inspection; all of the others placing at the disposal of the inspectors every possible facility, and acting promptly on all recommendations made.

We were able to secure the services of Dr. W. H. Watterson, who is now connected with the United States Public Health Service, and who has had perhaps a more varied experience in the operation of sanatoria, both large and small, public and private, than any other man in the middle West. In making the inspections, Dr. Watterson employed the scheme of rating adopted by the American Sanatorium Association* with certain minor modifications deemed advisable in view of the provisions of the Illinois Sanatorium Law, and it was definitely understood that the first ratings would not be made public, but would be used for the guidance of the sanatorium boards in bringing about desirable changes and reforms. It was made clear to the sanatorium boards, however, that subsequent inspec-

* The sanatorium score card of the American Sanatorium Association, based upon 100 points, allows 3 points for location and site; 5 points for plant and equipment; 18 points for institutional administration and 74 points for medical and nursing service.

tions would be made and that the results of all later ratings would be widely published for the guidance of the medical profession and the public.

The policy was pursued of allowing additional credit for exceptional features in institutional operation not ordinarily expected in sanatoria of that particular size and type and the practice was followed, in rating all institutions, to give no credit for unused or misused equipment, but rather to place the accent upon the character of professional service.

For example, an elaborate and expensive x-ray equipment entitled the institution to very little credit unless it was demonstrated that the methods of employment were technically correct and the medical staff capable of intelligent interpretation of their findings. The intelligent employment of artificial pneumothorax entitled the sanatorium to special credit, but if it was found that artificial pneumothorax was used excessively or unwisely, deductions were made on that account.

Inasmuch as the results of the ratings were frankly submitted in detail to the members of the sanatorium board and the medical staff, it became a source of considerable embarrassment to rate fairly the efficiency and intelligence of these persons. This, however, was performed by Dr. Watterson with the utmost tact and with the development of little or no friction. In one instance he announced to the members of the sanatorium board that he had rated the board as 50 per cent. efficient on the ground that, of the three members constituting the board, one had been absent from every meeting; while another had failed to attend half the meetings. Assuming 100 per cent. efficiency and fitness on the part of each member of the board, Dr. Watterson successfully contended that an absent member is a 100 per cent. useless and inefficient member.

Of the ten institutions inspected, one was rated as a class "A" sanatorium with a rating between 90 and 95 points; four were rated as class "B" institutions with a grade of from 80 to 89.9 points; while five were regarded as unworthy of classification. One rated as low as 48 points and another 49 points.

For the most part, sites, locations, and buildings were reasonably satisfactory, the large deductions being made on account of the inferior character of medical service.

A number of months have elapsed since the making of these inspections and it is now safe to say that this one inspection has accomplished a great deal in the elevation of standards of all Illinois public sanatoria. It was found that the more serious faults in institutional operation were due to a lack of knowledge on the part of sanatorium boards, and that these organizations were receptive of constructive advice and criticism. This was found true in driving home the one idea that every sanatorium must have a full-time specially trained medical director. The inspections served to improve distinctly the medical service of existing institutions and to pave the way for better conditions in the future.

It is to be hoped that the State Department of Public Health, whose personnel has been materially changed by political conditions, will see the wisdom of making supplemental inspections and re-ratings. This is par-

ticularly desirable in Illinois where, according to the interpretation of the attorney general, the law provides that it is not necessary for a county adopting the county sanatorium proposition actually to erect and maintain a sanatorium. At its discretion the sanatorium boards of smaller counties may employ the funds raised by the special sanatorium tax in placing tuberculous patients in institutions in other counties.* The frequent re-rating of sanatoria will not only afford reliable information to sanatorium boards in selecting the institutions in which their charges are to be placed, but will cause an elevation of standards among all county sanatoria seeking patronage from other counties.

While the inspection and rating of existing sanatoria have done much to improve the few institutions now in existence, they could have little influence upon the very large number of sanatoria to be established within the next few years. To avoid the serious mistakes already being made and to stimulate intelligent action on the part of county sanatorium boards that had remained entirely inactive, a campaign of intensive education became imperative. It was impossible for the Illinois Tuberculosis Association to send competent representatives into the fifty counties having sanatoria in contemplation, to remain long enough to win the confidence of the members of sanatorium boards and to exercise any great degree of influence. It was consequently decided to invite the members of all the sanatorium boards, together with members of boards of supervisors and county commissioners, with physicians, nurses, and other interested persons, to go on a personally conducted tour of inspection to a group of public and private sanatoria in Illinois.

The response to this invitation was astonishing. Three Pullman cars were comfortably filled and the journey was made to eleven different institutions, occupying a full week.

Attached to the train was a large baggage car whose walls were covered with exhibits, sanatorium plans, and educational material, and this car was used as a class-room on wheels by a staff of experts in every phase of tuberculosis work. The staff included clinicians, architects, sanitary engineers, institutional nurses, institutional managers, and visiting nurses.

At each town that was visited, there were held one or two large public meetings under the auspices of the local tuberculosis association and the county medical society and at these meetings the members of the teaching staff gave addresses on different phases of tuberculosis work, all of these lectures being so arranged that they constituted a connected course of instruction on some thirty different subjects.

On visiting the sanatoria, the party was divided into groups and each group was personally conducted by some one competent to criticize the institution intelligently, and at informal meetings held in the sanatoria, the architect, the medical director and the head nurse were requested to state the desirable features and the definite mistakes that had been made.

The number of persons taking part in this pilgrimage averaged about seventy throughout the trip; the number occasionally increasing to over a

*The uniting of counties to create district sanatoria is unconstitutional in Illinois.

hundred. It is believed that fully two hundred and fifty persons accompanied the party at one time or another; while fifty-five completed the entire itinerary.

In all of my experience, covering ten years in public tuberculosis work, I have never known an educational enterprise in which such keen enthusiasm and interest were manifested, nor one so directly productive of salutary results. The pilgrimage ended on May 14th, and within the month since that time there have been inaugurated numerous constructive activities in many counties of the state where distinct apathy prevailed prior to that time.

In one county, where the sanatorium is not yet constructed and where it appeared to be the impression that the county sanatorium was merely a question of brick and stone and mortar, a plan has been approved for the establishment of a central dispensary under competent direction and a chain of local clinics in every sizeable community.

One municipal official who manifested the utmost indifference on the first day of the pilgrimage and who expressed his intention of returning home the following day, accompanied the party throughout the week and left with the declaration that his community would immediately establish open air schools and nutrition classes as a part of the definite Illinois county sanatorium program.

Aside from the first-hand information received by the members of sanatorium boards and conveyed to them by practical demonstration rather than by word of mouth, the eleven institutions visited were tremendously helped by the frank criticisms of the pilgrims and of the experts who accompanied them, while in every community the visit of the pilgrims gave tremendous impetus to the work being carried out by the local sanatorium boards and the local tuberculosis associations.

With the idea firmly implanted in their minds that a tuberculosis sanatorium is merely a building which can be designed by any man claiming to be an architect, and directed by any man possessing a license to practice medicine; and with the notion that a county sanatorium is something of a pauper institution and closely akin to the pest house, it was tremendously interesting to see the development of opinion and the change in attitude which came over these men and women as the days of the pilgrimage passed. All of them returned to their homes satisfied that medical and nursing service are infinitely more important than buildings and equipment; all of them were convinced that tuberculosis dispensaries and visiting nurse service must precede the sanatorium; all of them were satisfied that open air schools, nutrition classes, and child welfare activities are a distinct part of the program of the county sanatorium. It is my profound conviction that the Illinois Sanatorium Pilgrimage will extend its influence in the elevation of standards of institutional care in the state for many years to come.

Incidentally, the pilgrims who had been fully advised as to the score card method of rating institutions, had an opportunity to see the limits of usefulness of the inspection and rating of public institutions. It was realized very definitely that there is no way by which one may reliably

rate that exceedingly important, but intangible thing, the personality of an institution and it was observed by the pilgrims that some of those institutions which were graded highest in the inspections made by Dr. Watterson failed to compare favorably with those less satisfactorily rated on account of the unfortunate personality or misguided point of view of an otherwise thoroughly competent and efficient personnel.

NATIONAL TUBERCULOSIS ASSOCIATION

BY-LAWS

LIST OF MEMBERS

December 1, 1921

BY-LAWS OF THE NATIONAL TUBERCULOSIS ASSOCIATION*

Article I — Name

The name of this Association shall be National Tuberculosis Association.

Article II — Objects

The objects of said Association are:

(a) The study of tuberculosis in all its forms and relations;

(b) The dissemination of knowledge concerning the causes, treatment and prevention of tuberculosis;

(c) The encouragement of the prevention and scientific treatment of tuberculosis;

(d) The stimulation, unification and standardization of the work of the various anti-tuberculosis agencies throughout the country, especially the state and local associations;

(e) The coöperation with all other health organizations in the coördination of health activities;

(f) The promotion of international relations in connection with health activities in the study and control of tuberculosis.

Article III — Seal

The seal of this corporation shall consist of a flat-faced circular die, with the words and figures, "National Tuberculosis Association, Corporate Seal, 1918, Maine," cut or engraved thereon.

Article IV — Membership

The members of this Association shall consist of five classes: (a) Members; (b) Life Members; (c) Corporate Members; (d) Representative Members; (e) Honorary Members.

(a) The persons who made application, dated September 6, 1918, for the incorporation of this corporation shall be members without payment of dues until the annual meeting of the members, to be held in 1919, and all persons who are members in good standing on September 25, 1918, of the voluntary association known as National Tuberculosis Association as shown by the Membership Ledger of said voluntary association now in possession of the Managing Director of said voluntary associa-

* Adopted at the meeting of the Board of Directors, held March 11, 1921.

tion, shall be members of this corporation with dues paid up to the time to which their respective dues in said voluntary association are paid up, and such members as shall from time to time be approved by the Executive Committee shall be members of this corporation. The dues of members shall be $5.00 a year.

(b) Members may become Life Members upon the payment of $100.

(c) Anti-tuberculosis associations other than Affiliated and Represented Associations, sanatoria, dispensaries, open-air schools, and similar agencies, libraries and industrial and other corporations, may be Corporate Members, with the approval of the Executive Committee, on payment of $5.00 or more per annum.

(d) Affiliated and Represented Associations, or persons representing such associations, if unincorporated, and selected by them, may be Representative Members, with the approval of the Board of Directors, on payment of $25 or more per annum.

Associations herein designated Affiliated and Represented Associations consist of State Tuberculosis Associations and certain other local associations hereinafter specified, which have and maintain the following qualifications:

(1) They shall not be under the direction or control of any state or local governmental agency;

(2) Such associations must have:

(a) A membership which has representation and participation in its affairs.

(b) A president and other officers, an Executive Committee, a salaried executive or similar officer, and a Board of Directors representative of the territory covered by the association.

(c) The membership must meet at least once a year; the Board of Directors or Executive Committee must meet at least four times a year.

(d) The association must operate under a constitution and by-laws, with an annual program and budget.

(e) The accounts must be audited by a certified public accountant or his equivalent at least once a year, and copy filed with the National Association.

(f) An annual report of accomplishments, receipts and expenditures shall be prepared and made available to officers, members and the public, and given all possible publicity.

(g) All associations shall comply with and carry out the aims and objects of the National Association, submitting such reports as may be required by the Association, and must accept the responsibility of working out and sharing with the National Association means of financing their mutual activities.

The other associations above referred to are the following: District of Columbia Tuberculosis Association, New York Tuberculosis Association, Committee on the Prevention of Tuberculosis of the Brooklyn Bureau of Charities, Tuberculosis League of Pittsburgh, Chicago Tuberculosis

Institute, and the Committee on Tuberculosis and Public Health of the State Charities Aid Association of New York.

The Board of Directors of the National Tuberculosis Association shall be the sole judge of the foregoing qualifications for Affiliated and Represented Associations, and of their right to membership and representation on the Board of Directors.

The Board of Directors, by a majority vote, may suspend the foregoing qualifications for Affiliated and Represented Associations between the period of June 13, 1921, and July 1, 1922.

(e) Persons distinguished for original researches relating to tuberculosis, or eminent as sanitarians or as philanthropists who have given material aid in the study and prevention of tuberculosis may be elected Honorary Members by the Board of Directors.

Any member failing to comply with the provisions of the By-Laws of this corporation shall thereupon cease to be a member.

Article V — Board of Directors

Section 1. The Board of Directors of this corporation shall consist of 50 members (designated herein as Directors at large), and an additional number of members (designated herein as Representative Directors), and they shall be divided into two classes of as nearly equal number as practicable. At the first annual meeting held after the adoption of these by-laws, one-half of the members, less any odd number, shall be elected for a term of one year and the other half and the odd member, if any, for a term of two years, and thereafter at each annual meeting there shall be elected for a term of two years directors equal in number to the class of Directors whose terms then expire, and for a term of one or two years, as circumstances may require, an additional number, if necessary, in order to fill all existing vacancies and to provide a Representative Director to represent each Affiliated and Represented Association, as provided in the next paragraph of this Article.

The Representative Directors shall be elected from persons nominated by the Affiliated and Represented Associations and in such manner that there shall be one and only one Representative Director for each such Affiliated and Represented Association, and there shall be in each class of Directors an equal number as near as may be of Representative Directors. Each person nominated by an Affiliated and Represented Association must be a member of the directorate of such association, and in the event that such Representative Director shall cease to be a member of such directorate, or his Affiliated and Represented Association shall cease to comply with the qualifications herein prescribed for such association, he shall *ipso facto* cease to be a member of the Board of Directors of this Association.

Retiring directors who have served two successive terms shall not be eligible for reëlection until one year after the year of their retirement.

At least one-third of the total number of the Directors at large shall

consist of laymen. The Board of Directors may, at its discretion, fill any or all vacancies caused by death, removal, resignation, disqualification or otherwise, of any of its members for the unexpired term at a regular meeting of the Board, provided that written notice specifying the vacancies to be filled be given in hand or mailed to each member of the Board at least twenty days in advance of the meeting. Vacancies in the ranks of Representative Directors shall be filled from nominations made by the Affiliated and Represented Associations in question.

On June 15, 1921, at twelve o'clock noon, the terms of office of the Board of Directors then in office shall cease and terminate and the new directors, elected as herein provided, shall assume office forthwith.

SECTION 2. Except as otherwise provided in these By-Laws the Board of Directors shall have entire charge and control of the business and property of the corporation, the planning of the work, the fixing of the time and place for the annual or special meetings of the members to be held in the State of Maine for the election of Directors or for any other purpose and the arrangements for congresses, legislation and all other matters pertaining to its affairs.

SECTION 3. The Board of Directors is empowered to appoint representatives on national or international committees or other agencies that deal with tuberculosis or public health work. It shall also from time to time appoint such committees as may be necessary for scientific, charitable and educational work and for the holding of meetings and congresses.

SECTION 4. Seven Directors shall constitute a quorum.

ARTICLE VI — OFFICERS

SECTION 1. The officers of the corporation shall be a President, two Vice-Presidents, a Secretary, a Treasurer, a Clerk and such other officers or agents as the Board of Directors may from time to time elect. All of the officers of the corporation, with the exception of the Clerk, shall be elected annually by the Board of Directors. The Directors and the Clerk shall be elected annually by the members. The President must be a member of the Board of Directors. The other officers may be, but need not be, members of such Board.

SECTION 2. All officers shall perform the duties commonly incident to their respective offices, and shall perform such other duties and have such other powers as are prescribed by these By-Laws or as the Board of Directors or the Executive Committee shall from time to time designate.

The Secretary, or in his absence a secretary *pro tempore* shall keep correct minutes of all meetings of the Board of Directors and of the Executive Committee.

The Clerk, or in his absence a clerk *pro tempore* shall keep correct minutes of all meetings of the members.

The Clerk or clerk *pro tempore* shall be sworn to the faithful performance of his duties.

Article VII — Executive Committee

There shall be an Executive Committee, composed of the President and Vice-Presidents, Treasurer and Secretary ex officio and seven members of the Board — the latter to be elected annually by the Board, which Committee shall exercise all the powers of the Board of Directors when the Board is not in session and such powers as are conferred by these By-Laws, subject to the approval of the Board.

Article VIII — Meetings

Section 1. *Meetings of Members.* A meeting of the Members of the corporation shall be held annually at the office of the corporation in Portland, Maine, at such time as may be fixed by the Board of Directors or by the Executive Committee. Special meetings of the Members shall be held at said office of the corporation when so ordered by the Board of Directors. Notice of the time and place of all meetings of the Members, and in the case of special meetings of the business to be transacted, shall be published by the Clerk once, at least seven days* before the meeting, in some newspaper published in Portland, Maine. Each Member, Life Member, Corporate Member and Representative Member shall be entitled to one vote. Members and Life Members may vote at meetings either in person or by written proxy. Corporate members may vote by their duly authorized representatives or such representatives' proxy in writing. Ten members entitled to vote, present either in person or by proxy, shall constitute a quorum.

* As amended November 14, 1918.

Section 2. *Meetings of the Board of Directors.* Regular meetings of the Board of Directors shall be held in such places and at such times as the Board may by vote from time to time determine; and if so determined, no notice thereof need be given. Special meetings of the Board of Directors may be held at any time or place whenever called by the President, reasonable notice thereof being given to each Director, or at any time without formal notice, provided all the Directors are present, or those not present have waived notice thereof in writing. Such special meetings shall be held at such times and places as the notice thereof or waiver shall specify.

Section 3. *Meetings of the Executive Committee.* The Executive Committee shall hold meetings when called by the President.

Article IX — Moneys

Moneys received from membership dues and from all other sources shall be used for defraying the expenses of the corporation and furthering its objects under the direction of the Board of Directors. The Treasurer shall keep proper accounts of all receipts and disbursements, which accounts shall be subject to the supervision of the Board of Directors.

Article X — Amendment of By-Laws

These By-Laws may be altered, amended or repealed by a two-thirds vote of the members of the Board of Directors present at a meeting of the Board, provided that the proposition to amend has been presented in writing at a previous meeting of the Board and that subsequent to such presentation twenty days' notice in writing has been given of the proposed amendment in the call for the meeting.

GEOGRAPHICAL LIST OF MEMBERS

LIFE MEMBERS

Barrel, Finley, Chicago
Blumenthal, George, New York
Clark, F. A., New York
Fisk, Harvey Edward, New York
Harkness, Edward S., New York
Harris, Emma Gale, Chicago
Higginson, Henry L., Boston
Knickerbacker, Mrs. H., New York
Knopf, Dr. S. Adolphus, New York
Larson, Ejnar, Wayne, Neb.
Lewisohn, Adolph, New York
McCormick, Cyrus H., Chicago
Macy, V. Everit, New York
Maloney, Martin, Philadelphia
Marshall, Louis, New York
Mather, Samuel, Cleveland
May, Francis E., Chicago
Phipps, Henry, New York
Platt, Henry B., New York
Rockefeller, John D., New York
Swift, L. F., Chicago
Wanamaker, Rodman, Philadelphia
Warburg, Felix M., New York

CONTRIBUTORS

1920

Alling, Mrs. Joseph T.
Allis, Louis
Auchincloss, John W.
Bancroft, William P.
Bridge, Dr. Norman
Cutting, Mrs. W. Bayard
Emerson, Mr. and Mrs. William
Herschel, Mr. and Mrs. A. H.
Hoopes, Maurice
Kopeloff, N.
Liveright, Mrs. S.
Madeira, Mrs. Louis G.
Milius, Clarence
Miller, R. E.
Neilson, Mrs. Francis
Reifsnyder, Howard
Segal, George
Seiter, H. F.
Tucker, Miss Margaret
Wilson, E. F.
Winchester, Bishop James R.

GEOGRAPHICAL LIST OF THE MEMBERS OF THE NATIONAL TUBERCULOSIS ASSOCIATION, DECEMBER 1, 1921

ALABAMA

ALABAMA TUBERCULOSIS ASSOCIATION,
Mrs. H. E. Pearce, Representative Member, Birmingham
ALLEN, WILLIAM B., Birmingham
CALHOUN COUNTY ANTI-TUBERCULOSIS LEAGUE, Anniston
CARTER, DR. H. R., JR., Birmingham
DOWE, MISS LUCY, Montgomery
DUGGAN, MISS ADELE, Eufaula
EAVES, REV. GEORGE, D.D., Birmingham
FAIRBAIRN, C. T., Birmingham
LEWIS, DR. T. K., Birmingham
LULL, DR. CABOT, Birmingham
MUNGER, R. S., Birmingham
PRICE, BEN, Birmingham
WELCH, DR. S. W., Montgomery

ARGENTINA

NOREAU, DR. ALICIA, Buenos Aires

ARIZONA

ARIZONA ANTI-TUBERCULOSIS ASSOCIATION,
Dr. John W. Flinn, Representative Member, Phoenix
BABBIT, DAVID, Flagstaff
BOLDING, JOHN ALBERT, Tucson
BROWN, DR. O. H., Phoenix
CLYNE, DR. MEADE, Tucson
COCKS, REV. BERTRAND, Phoenix
COHEN, DR. M. D., Tucson
CUVELLIER, T. C., Phoenix
EVANS, MRS. H. D., Mesa
FIDELIA, SISTER M., Tucson
FISCHER, GEORGE A., Phoenix
FLINN, DR. JOHN W., Prescott
FREDERICKS, R. N., Prescott
HAZELTINE, M. B., Prescott
HAZELTINE, MRS. M. B., Prescott
HOLMES, FRED G., Phoenix
KEENEY, DR. MADISON J., Phoenix
LABEN, DR. GEORGE, Supai
METZGER, DR. JEREMIAH, Tucson
MILLER, DR. FREDERICK, Miami
MILLS, DR. CHARLES W., Tucson
OLIVER, DR. L. H., Prescott
PHILLIPS, DR. E. W., Phoenix
PHOENIX SANATORIUM, Phoenix
POLLOCK, T. E., Flagstaff
POLLOCK, MRS. T. E., Flagstaff
RANDOLPH, COL. EPES, Tucson
SHINE, DR. FRANCIS E., Bisbee
THOMAS, DR. C. A., Tucson
WALTON, WILLIAM, Palo Verde
WATSON, DR. SAMUEL H., Tucson
WILSON, DR. A. D., Prescott

ARKANSAS

ABEL, MISS MARY ANN, Helena
ABELES, CHARLES T., Little Rock
ARKANSAS TUBERCULOSIS ASSOCIATION, Little Rock
BILLINGSLEY, MRS. W. A., Newport
COOPER CLINIC, Fort Smith
GRAND LODGE A. O. U. W. OF ARKANSAS, Little Rock
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LATKIN, MISS LENA, Little Rock
PFEIFER BROTHERS, Little Rock
SCHAFFER, MRS. CHARLES L., Little Rock
SHIPP, DR. A. C., Little Rock
TARKINGTON, DR. G. E., Hot Springs
TERRY, MRS. D. D., Little Rock
WILLIAMS, HAMP, Hot Springs

BRAZIL

SOUZA, DR. GERALDO H., Sao Paulo

CALIFORNIA

ALAMEDA COUNTY SOCIETY FOR THE STUDY AND PREVENTION OF TUBERCULOSIS, Oakland
ANDERSON, DR. JENNIE, Los Angeles
ANDERSON, DR. OSCAR, Santa Monica
ATKINSON, CHARLES E., Banning
AYER, HAROLD O., Pasadena
BAGG, DR. C. P., Los Angeles
BARLOW, DR. W. JARVIS, Los Angeles
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BINE, DR. RENE, San Francisco
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BREM, DR. WALTER V., Los Angeles
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BROOKS, DR. STEPHEN D., Los Angeles
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BROWNING, DR. CHARLES C., Los Angeles
BRUST, MRS. S. M. B., San Diego
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BURNSIDE, DR. CHARLES, Los Angeles
BUSH, DR. CHESLEY, Livermore
CALIFORNIA TUBERCULOSIS ASSOCIATION, Dr. Robert A. Peers, Representative Member, Fresno
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CHAIN, DR. JOHN N., Eureka
CHATFIELD-TAYLOR, H. C., Santa Barbara
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COCHRAN, GEORGE I., Los Angeles
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CONN, DR. WALTER SCOTT, Palo Alto
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DIBBLIE, MRS. BENJAMIN, Ross
DICKSON, DR. C. B., Los Angeles
DUNHAM, DR. R. W., Soldiers' Home
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EVANS, DR. GEORGE H., San Francisco
EVANS, DR. NEWTON, Loma Linda
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FORD, MRS. TOD, Pasadena
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GOSNEY, E. S., Pasadena
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HARRIS, DR. MARY W., San Francisco
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HENDRY, GEORGE W., San Francisco
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JOHNSON, MRS. REGINALD, Pasadena
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KENT, HON. WILLIAM, Kentfield
KING, DR. ERNEST HAROLD, LaVina
KIRSCHNER, DR. H. EDWARD, Monrovia
KOCHER, DR. R. A., San Diego
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LISSNER, DR. HENRY H., Los Angeles
LOS ANGELES COUNTY HOSPITAL, Los Angeles
LOS ANGELES TUBERCULOSIS ASSOCIATION, Los Angeles
LUCKIE, DR. J. B., Pasadena
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MCKENNEY, DR. J. A., Parlier
MCKEON, DR. F. H., Camp Kearney
MACKERRAS, DR. R. H., Pasadena
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METCALF, DR. JULIA T., Los Angeles
MITCHELL, ROBERT, Sierra Madre
MONTEREY COUNTY TUBERCULOSIS ASSOCIATION, Salinas
MORRISON, DR. M. M., Camp Kearney
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NEILSON, JOHN C. E., San Diego
NEVIUS, DR. JOHN W., Los Angeles
OLIVE VIEW SANATORIUM, San Fernando
ONTARIO-UPLAND ASSOCIATION FOR STUDY AND PREVENTION OF TUBERCULOSIS, Ontario
OPHULS, DR. WILLIAM, San Francisco
PASADENA TUBERCULOSIS ASSOCIATION, Pasadena
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PERRY, J. C., San Francisco
PIERSON, DR. PHILIP K., San Francisco
PIKE, ROBERT D., Los Gatos
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POTTENGER, DR. J. E., Monrovia
REMINGTON, CAPT. LEWIS D., Monrovia
RITTENHOUSE, DR. W., San Diego
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R. R. ROGERS CHEMICAL COMPANY, San Francisco
ROSENCRANTZ, DR. ESTHER, San Francisco

ROTHSCHILD, DR. MAX, San Francisco
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SAN FRANCISCO TUBERCULOSIS ASSOCIATION, San Francisco
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STREET, DR. LIONEL, Los Angeles
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THORNING, E. B., Oakland
TOMBS, JOHN, La Vina
TOOKER, DR. FRED J., Los Gatos
TULARE-KINGS COUNTY JOINT TUBERCULOSIS HOSPITAL, Springville
VON ADELUNG, DR. E., Oakland
VAN ZWALENBURG, DR. G., Riverside
VISITING NURSE ASSOCIATION, Monrovia
VISSCHER, DR. L. G., Los Angeles
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WEBER, DR. A. L., Cucamonga
WEIMAR JOINT SANATORIUM, Weimar
WELFARE AND PUBLIC HEALTH SERVICE, San Mateo
WHEATE, DR. JUSTUS M., Palo Alto
WHEELER, MRS. R. A. S., Pasadena
WILLIAMS, DR. ALLEN H., Santa Barbara

CANADA

ADAMSON, DR. J. D., Winnipeg, Man.
ANGLIN, DR. GEORGE C., Toronto, Ont.
ARCHIBALD, DR. EDWARD, Montreal, Que.
BAILLIE, DR. D. M., Victoria, B. C.
BAYLISS, J. J., Hamilton, Ont.
BAYNE, DR. C. M., Kentville, N. S.
BOUGHTON, DR. HARVEY C., Ft. Qu'Appelle, Sask.
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BUSHBY, DR. E. M., Montreal, Que.
BYERS, DR. J. RODDICK, St. Agathe des Monts, Que.
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CAULFIELD, DR. A. H. W., Toronto, Ont.
CHOLETTE, DR. A. M., Montreal, Que.
COLLINS, DR. RUSSELL JOHNSON, Kentville, N. S.
COOK, DR. A. B., Regina, Sask.
COUILLARD, DR. J. A., Quebec, Que.
CRAIG, DR. D. A., Halifax, N. S.
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Smith, Mrs. W. C., Galesburg
Spellman, Mrs. J. W., Lincoln
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Thompson, Norman F., Rockford
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Worthington, Dr. Harry C., Quincy
Young, A. B., Evanston
Zickert, Miss Gertrude L., Freeport

INDIA

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Kipp, Dr. Cora I., Tilaunia Rajputana
Selkar, Dr. Chandra, Madras
Vakil, Dr. Sorale B., Bombay

INDIANA

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Bartholomew County Tuberculosis Association, Columbus
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Beasley, Dr. Thomas J., Indianapolis
Blaker, Mrs. Elizabeth A., Indianapolis
Block, A. J., Indiana Harbor
Butler, Amos W., Indianapolis
Carter, Dr. Amos, Rockville
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Collmer, Miss Irma, South Bend
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Crull, Dr. Eric, Fort Wayne
Cummings, Mrs. Ralph, Gary
Darden, Dr. St. C., South Bend
DeKalb County Anti-Tuberculosis Society, Auburn
Delaware County Tuberculosis Association, Muncie
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Foor, Dr. J. D., Terre Haute
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Franklin County Tuberculosis Society, Brookville
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Fort Wayne Anti-Tuberculosis League, Fort Wayne
Gary Screw & Bolt Company, Gary
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Hatfield, Dr. Sidney J., Indianapolis
Hawley, Miss Edith, Huntington
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Hays, J. W., Indianapolis
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Johnson, J. S., Evansville
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McCaskey, C. H., Indianapolis
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Vanderburgh County Tuberculosis Association, Evansville
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Vonnegut, Franklin, Indianapolis
Weatherhogg, C. R., Fort Wayne
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Willett, Dr. T., Evansville
Wood Mosaic Company, New Albany
Woolen, G. V., Indianapolis
Woolen, H. M., Indianapolis

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Breid, Dr. Jacob, Toledo
Brooks, Dr. A. L., Audubon
Cary, Dr. Walter, Dubuque
Childs, Mrs. R. F., Audubon
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Emerson, Mrs. Gertrude, Clinton
Ficke, R. C., Davenport
Field, Dr. C. G., Fort Dodge
Gibson, Dr. J. I., Des Moines
Grimes, Dr. Eli, Des Moines
Groening, Dr. C. H., Waverly
Harrington, Dr. B., North English
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Herrick, Dr. J. F., Ottumwa
Hershey, Miss Adah L., Des Moines
Hubbel, F. C., Des Moines
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Ottumwa Commercial Club, Ottumwa
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Rich, Mrs. C. M., Keokuk
Ross, William H., Waterloo
Russell, Dr. John, Des Moines
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Social Welfare League, Waterloo
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Stewart, W. C., West Union
Wapello County Public Health Bureau, Ottumwa
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Trimble, Dr. Andrew, Belfast

JAPAN

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Nishida, Dr. Yoshio, Lcem
Takahashi, Dr. Seichi, Kanagawa-Ken

KANSAS

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Michener, Dr. H., Wichita
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Grainger, Dr. Laura, Franklin
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Kentucky Tuberculosis Association, Louisville
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Scott, Dr. John W., Lexington
Sprague, Dr. George P., Lexington
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Wiedemann, Charles, Newport
Wiedemann, Mrs. Charles, Newport
Yancy, Miss J. O., Louisville

LOUISIANA

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Beekman's, New Orleans
Bel, Dr. George S., New Orleans
Bernhard, Dr. Robert, New Orleans
Bryce, Mrs. Alice G., Minden
Burnam, Mrs. George S., New Orleans
Caffery, John M., Franklin
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De Sota Anti-Tuberculosis League, Mansfield
Dowling, Dr. Oscar, New Orleans
Durel, Dr. Wallace J., New Orleans
Elliott, Dr. John B., Jr., New Orleans
Grisham, O. M., Monroe
Horton, Dr. C. M., Franklin
Jackson, Mrs. H. H., Jeanerette
Jefferson Davis Parish Tuberculosis League, Jennings
Louisiana Anti-Tuberculosis League, New Orleans
McDerby, Col. George, New Orleans
Matas, Dr. Rudolph, New Orleans
Orleans Anti-Tuberculosis League, New Orleans
Ouachita Parish Tuberculosis League, West Monroe
Park, Dr. William E., Alexandria
Sandoz, Miss Gertrude, Opelousas
Shreveport Tuberculosis League, Shreveport
Stites, Dr. Thomas H. A., Alexandria
Terrebonne Parish Tuberculosis League, Houma
Williams, L. M., New Orleans

MAINE

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Hardy, Dr. Theodore E., Waterville
Madeira, Miss Edith, Ogunquit
Maine Public Health Association, Augusta
Nichols, Dr. Estes, Portland
Northern Maine Sanatorium, Presque Isle
O'Brien, Dr. Carl R., Bangor
Payson, Herbert, Portland

* Deceased.

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SHAW, JOHN F., Fairfield
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WELCH, DR. FRANCIS J., Portland
WOODMAN, EDWARD, Portland

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MASSACHUSETTS

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Cummings, Mrs. Charles A.
Cushing, Mrs. W. E.
Cutler, Dr. Elbridge G.
Dennen, Dr. Ernest J.
Emerson, Dr. William R. P.
Fessenden, R. G.
Floyd, Dr. Cleaveland
Folsom, Miss Amy
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Hemenway, Augustus
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Johnson, Arthur S.
Johnson, Dr. F. W.
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Keene, Dr. C. H.
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O'Brien, Dr. John F.
Otis, Dr. Edward O.
Page, Dr. Calvin Gates
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Shattuck, Dr. George C.
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Thorndike, Dr. Augustus
Van De Linda, Frank
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White, Dr. Benjamin
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Wing, Frank E.
Woodward, Dr. William C.

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Adriance, Dr. Vanderpoel, Williamstown
Adriance, Mrs. Vanderpoel, Williamstown
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American Red Cross, Amesbury
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Barnstable County Public Health Association, Dennis
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Bill, Nathan D., Springfield
Borden, R. P., Fall River
Bowditch, Edward, West Roxbury
Bradley, Rosamond, Prides Crossing
Bristol County Tuberculosis Hospital, Attleboro
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Detroit Tuberculosis Society, Detroit
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Dyer, Miss Clara E., Detroit
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Gratiot County Good Health Society, Alma
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Herman, R., Detroit
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Hubbard, Mrs. E. W., Flint
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Jackson, Dr. John B., Kalamazoo
Jennings, Dr. Charles G., Detroit
Johnston, Dr. Collins H., Grand Rapids
Joy, R. P., Detroit
Kellogg, Dr. J. H., Battle Creek
Kimball, Dr. A. S., Battle Creek
Knappen, Hon. Loyal E., Grand Rapids
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Macklem, Dr. Glen Edrie, Detroit
Meader, Dr. F. M., Detroit
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Muskegon County Tuberculosis Association, Muskegon
Nesbitt, Dr. Eugene N., Grand Rapids
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Gomez de Molina, Dr. J., Loomis
Goler, Dr. G. W., Rochester
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Harrington, Irving J., Port Jervis
Hartnack, Dr. Knud, Fox Hills
Havemeyer, J. C., Yonkers
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Lomb, Carl F., Rochester

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Saranac Lake Society for Control of Tuberculosis, Saranac Lake
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Bixby, Tams, Muskogee
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Ellison, Dr. Gayfree, Norman
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Farmer, A. L., Tulsa
Fishman, Dr. C. J., Oklahoma City
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Gunter, Charles W., Oklahoma City
Hardy, Dr. Harrell, Poteau
Luhn, R. E., Jr., Oklahoma City
McHenry, D. D., Oklahoma City
Mackay, Miss Rosalind, Oklahoma City
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Metcalf, Rev. William, Bartlesville
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Oklahoma Public Health Association, Oklahoma City
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Pottawatomie County Public Health Association, Shawnee
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Brinton, Dr. Ward
Bromley, Mrs. Charles S.
Bromley, Joseph H.
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Carpenter, Dr. William H.
Castner, Samuel, Jr.
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Wisconsin Anti-Tuberculosis Association, Milwaukee
Youmans, Laurel E., Mukwonago

WYOMING

Blake, Dr. I. W., Buffalo
McGovern, Bishop, Cheyenne
Wyoming Public Health Association, Dr. J. D. Shingle, Representative Member, Cheyenne

* Deceased.

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